

THERMAL DYNAMICS[®]



A THERMADYNE[®] Company

PAK ***MASTER[®]*** ***25***

Air Plasma Cutting System

For 120VAC Systems

The System Includes:

- ***Pak Master[®] 25TM Power Supply***
- ***PCH-25 Torch with Leads***
- ***Input Power Cable***
- ***Work Cable with Clamp***

Instruction Manual

**WARNING**

Read and understand this entire Instruction Manual and your employer's safety practices before installing, operating, or servicing the equipment.

**WARNING**

While the information contained in this instruction manual represents our best judgement, Thermal Dynamics Corporation assumes no liability for its use.

Pak Master 25 Air Plasma Cutting System(120VAC)
Instruction Manual No. 0-2402

Published by
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(603) 298-5711

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Record Serial Numbers For Warranty Purposes

Purchase Date

Power Supply

Torch

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SECTION 1: GENERAL INFORMATION

1.01 Notes, Cautions and Warnings

Throughout this manual, notes, cautions, and warnings are used to highlight important information. These highlights are categorized as follows:

NOTE

An operation, procedure, or background information which requires additional emphasis or is helpful in efficient operation of the system.

CAUTION

A procedure which, if not properly followed, may cause damage to the equipment.



WARNING

A procedure which, if not properly followed, may cause injury to the operator or others in the operating area.

1.02 Important Safety Precautions



WARNINGS

OPERATION AND MAINTENANCE OF PLASMA ARC EQUIPMENT CAN BE DANGEROUS AND HAZARDOUS TO YOUR HEALTH.

Plasma arc cutting produces intense electric and magnetic emissions that may interfere with the proper function of cardiac pacemakers, hearing aids, or other electronic health equipment. Persons who work near plasma arc cutting applications should consult their medical health professional and the manufacturer of the health equipment to determine whether a hazard exists.

To prevent possible injury, read, understand and follow all warnings, safety precautions and instructions before using the equipment. Call 1-603-298-5711 or your local distributor if you have any questions.



GASES AND FUMES

Gases and fumes produced during the plasma cutting process can be dangerous and hazardous to your health.

- Keep all fumes and gases from the breathing area. Keep your head out of the welding fume plume.
- Use an air-supplied respirator if ventilation is not adequate to remove all fumes and gases.
- The kinds of fumes and gases from the plasma arc depend on the kind of metal being used, coatings on the metal, and the different processes. You must be very careful when cutting or welding any metals which may contain one or more of the following:

Antimony	Chromium	Mercury
Arsenic	Cobalt	Nickel
Barium	Copper	Selenium
Beryllium	Lead	Silver
Cadmium	Manganese	Vanadium

- Always read the Material Safety Data Sheets (MSDS) that should be supplied with the material you are using. These MSDSs will give you the information regarding the kind and amount of fumes and gases that may be dangerous to your health.
- For information on how to test for fumes and gases in your workplace, refer to item 1 in Subsection 1.03, Publications in this manual.
- Use special equipment, such as water or down draft cutting tables, to capture fumes and gases.
- Do not use the plasma torch in an area where combustible or explosive gases or materials are located.
- Phosgene, a toxic gas, is generated from the vapors of chlorinated solvents and cleansers. Remove all sources of these vapors.



ELECTRIC SHOCK

Electric Shock can injure or kill. The plasma arc process uses and produces high voltage electrical energy. This electric energy can cause severe or fatal shock to the operator or others in the workplace.

- Never touch any parts that are electrically "live" or "hot."
- Wear dry gloves and clothing. Insulate yourself from the work piece or other parts of the welding circuit.
- Repair or replace all worn or damaged parts.
- Extra care must be taken when the workplace is moist or damp.

- Install and maintain equipment according to NEC code, refer to item 9 in Subsection 1.03, Publications.
- Disconnect power source before performing any service or repairs.
- Read and follow all the instructions in the Operating Manual.



FIRE AND EXPLOSION

Fire and explosion can be caused by hot slag, sparks, or the plasma arc.

- Be sure there is no combustible or flammable material in the workplace. Any material that cannot be removed must be protected.
- Ventilate all flammable or explosive vapors from the workplace.
- Do not cut or weld on containers that may have held combustibles.
- Provide a fire watch when working in an area where fire hazards may exist.
- Hydrogen gas may be formed and trapped under aluminum workpieces when they are cut underwater or while using a water table. **DO NOT** cut aluminum alloys underwater or on a water table unless the hydrogen gas can be eliminated or dissipated. Trapped hydrogen gas that is ignited will cause an explosion.



NOISE

Noise can cause permanent hearing loss. Plasma arc processes can cause noise levels to exceed safe limits. You must protect your ears from loud noise to prevent permanent loss of hearing.

- To protect your hearing from loud noise, wear protective ear plugs and/or ear muffs. Protect others in the workplace.
- Noise levels should be measured to be sure the decibels (sound) do not exceed safe levels.
- For information on how to test for noise, see item 1 in Subsection 1.03, Publications, in this manual.



PLASMA ARC RAYS

Plasma Arc Rays can injure your eyes and burn your skin. The plasma arc process produces very bright ultra violet and infra red light. These arc rays will damage your eyes and burn your skin if you are not properly protected.

- To protect your eyes, always wear a welding helmet or shield. Also always wear safety glasses with side shields, goggles or other protective eye wear.
- Wear welding gloves and suitable clothing to protect your skin from the arc rays and sparks.
- Keep helmet and safety glasses in good condition. Replace lenses when cracked, chipped or dirty.
- Protect others in the work area from the arc rays. Use protective booths, screens or shields.
- Use the shade of lens as suggested in the following per ANSI/ASC Z49.1:

Arc Current	Minimum Protective Shade No.	Suggested Shade No.
Less Than 300*	8	9
300 - 400*	9	12
400 - 800*	10	14

** These values apply where the actual arc is clearly seen. Experience has shown that lighter filters may be used when the arc is hidden by the work-piece.*

1.03 Publications

Refer to the following standards or their latest revisions for more information:

1. OSHA, SAFETY AND HEALTH STANDARDS, 29CFR 1910, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
2. ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
3. NIOSH, SAFETY AND HEALTH IN ARC WELDING AND GAS WELDING AND CUTTING, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
4. ANSI Standard Z87.1, SAFE PRACTICES FOR OCCUPATION AND EDUCATIONAL EYE AND FACE PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018
5. ANSI Standard Z41.1, STANDARD FOR MEN'S SAFETY-TOE FOOTWEAR, obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018
6. ANSI Standard Z49.2, FIRE PREVENTION IN THE USE OF CUTTING AND WELDING PROCESSES, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018
7. AWS Standard A6.0, WELDING AND CUTTING CONTAINERS WHICH HAVE HELD COMBUSTIBLES, obtainable from American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126

8. NFPA Standard 51, OXYGEN-FUEL GAS SYSTEMS FOR WELDING, CUTTING AND ALLIED PROCESSES, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
9. NFPA Standard 70, NATIONAL ELECTRICAL CODE, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
10. NFPA Standard 51B, CUTTING AND WELDING PROCESSES, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
11. CGA Pamphlet P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS, obtainable from the Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202
12. CSA Standard W117.2, CODE FOR SAFETY IN WELDING AND CUTTING, obtainable from the Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3
13. NWSA booklet, WELDING SAFETY BIBLIOGRAPHY obtainable from the National Welding Supply Association, 1900 Arch Street, Philadelphia, PA 19103
14. American Welding Society Standard AWSF4.1, RECOMMENDED SAFE PRACTICES FOR THE PREPARATION FOR WELDING AND CUTTING OF CONTAINERS AND PIPING THAT HAVE HELD HAZARDOUS SUBSTANCES, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
15. ANSI Standard Z88.2, PRACTICE FOR RESPIRATORY PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018

1.04 Note, Attention et Avertissement

Dans ce manuel, les mots “note,” “attention,” et “avertissement” sont utilisés pour mettre en relief des informations à caractère important. Ces mises en relief sont classifiées comme suit :

NOTE

Toute opération, procédure ou renseignement général sur lequel il importe d'insister davantage ou qui contribue à l'efficacité de fonctionnement du système.

ATTENTION

Toute procédure pouvant résulter l'endommagement du matériel en cas de non-respect de la procédure en question.



AVERTISSEMENT

Toute procédure pouvant provoquer des blessures de l'opérateur ou des autres personnes se trouvant dans la zone de travail en cas de non-respect de la procédure en question.

1.05 Precautions De Securite Importantes



AVERTISSEMENTS

L'OPÉRATION ET LA MAINTENANCE DU MATÉRIEL DE SOUDAGE À L'ARC AU JET DE PLASMA PEUVENT PRÉSENTER DES RISQUES ET DES DANGERS DE SANTÉ.

Coupant à l'arc au jet de plasma produit de l'énergie électrique haute tension et des émissions magnétique qui peuvent interférer la fonction propre d'un "pacemaker" cardiaque, les appareils auditif, ou autre matériel de santé électronique. Ceux qui travail près d'une application à l'arc au jet de plasma devrait consulter leur membre professionnel de médication et le manufacturier de matériel de santé pour déterminer s'il existe des risques de santé.

Il faut communiquer aux opérateurs et au personnel TOUS les dangers possibles. Afin d'éviter les blessures possibles, lisez, comprenez et suivez tous les avertissements, toutes les précautions de sécurité et toutes les consignes avant d'utiliser le matériel. Composez le + 603-298-5711 ou votre distributeur local si vous avez des questions.



FUMÉE et GAZ

La fumée et les gaz produits par le procédé de jet de plasma peuvent présenter des risques et des dangers de santé.

- Eloignez toute fumée et gaz de votre zone de respiration. Gardez votre tête hors de la plume de fumée provenant du chalumeau.
- Utilisez un appareil respiratoire à alimentation en air si l'aération fournie ne permet pas d'éliminer la fumée et les gaz.

- Les sortes de gaz et de fumée provenant de l'arc de plasma dépendent du genre de métal utilisé, des revêtements se trouvant sur le métal et des différents procédés. Vous devez prendre soin lorsque vous coupez ou soudez tout métal pouvant contenir un ou plusieurs des éléments suivants:

antimoine	cadmium	mercure
argent	chrome	nickel
arsenic	cobalt	plomb
baryum	cuiivre	sélénium
béryllium	manganèse	vanadium

- Lisez toujours les fiches de données sur la sécurité des matières (sigle américain "MSDS"); celles-ci devraient être fournies avec le matériel que vous utilisez. Les MSDS contiennent des renseignements quant à la quantité et la nature de la fumée et des gaz pouvant poser des dangers de santé.
- Pour des informations sur la manière de tester la fumée et les gaz de votre lieu de travail, consultez l'article 1 et les documents cités à la page 5.
- Utilisez un équipement spécial tel que des tables de coupe à débit d'eau ou à courant descendant pour capter la fumée et les gaz.
- N'utilisez pas le chalumeau au jet de plasma dans une zone où se trouvent des matières ou des gaz combustibles ou explosifs.
- Le phosgène, un gaz toxique, est généré par la fumée provenant des solvants et des produits de nettoyage chlorés. Éliminez toute source de telle fumée.



CHOC ELECTRIQUE

Les chocs électriques peuvent blesser ou même tuer. Le procédé au jet de plasma requiert et produit de l'énergie électrique haute tension. Cette énergie électrique peut produire des chocs graves, voire mortels, pour l'opérateur et les autres personnes sur le lieu de travail.

- Ne touchez jamais une pièce "sous tension" ou "vive"; portez des gants et des vêtements secs. Isolez-vous de la pièce de travail ou des autres parties du circuit de soudage.
- Réparez ou remplacez toute pièce usée ou endommagée.
- Prenez des soins particuliers lorsque la zone de travail est humide ou moite.
- Montez et maintenez le matériel conformément au Code électrique national des Etats-Unis. (Voir la page 5, article 9.)
- Débranchez l'alimentation électrique avant tout travail d'entretien ou de réparation.
- Lisez et respectez toutes les consignes du Manuel de consignes.



INCENDIE ET EXPLOSION

Les incendies et les explosions peuvent résulter des scories chaudes, des étincelles ou de l'arc de plasma. Le procédé à l'arc de plasma produit du métal, des étincelles, des scories chaudes pouvant mettre le feu aux matières combustibles ou provoquer l'explosion de fumées inflammables.

- Soyez certain qu'aucune matière combustible ou inflammable ne se trouve sur le lieu de travail. Protégez toute telle matière qu'il est impossible de retirer de la zone de travail.
- Procurez une bonne aération de toutes les fumées inflammables ou explosives.
- Ne coupez pas et ne soudez pas les conteneurs ayant pu renfermer des matières combustibles.
- Prévoyez une veille d'incendie lors de tout travail dans une zone présentant des dangers d'incendie.
- Le gas hydrogène peut se former ou s'accumuler sous les pièces de travail en aluminium lorsqu'elles sont coupées sous l'eau ou sur une table d'eau. NE PAS couper les alliages en aluminium sous l'eau ou sur une table d'eau à moins que le gas hydrogène peut s'échapper ou se dissiper. Le gas hydrogène accumulé explosera si enflammé.



RAYONS D'ARC DE PLASMA

Les rayons provenant de l'arc de plasma peuvent blesser vos yeux et brûler votre peau. Le procédé à l'arc de plasma produit une lumière infra-rouge et des rayons ultra-violets très forts. Ces rayons d'arc nuiront à vos yeux et brûleront votre peau si vous ne vous protégez pas correctement.

- Pour protéger vos yeux, portez toujours un casque ou un écran de soudeur. Portez toujours des lunettes de sécurité munies de parois latérales ou des lunettes de protection ou une autre sorte de protection oculaire.
- Portez des gants de soudeur et un vêtement protecteur approprié pour protéger votre peau contre les étincelles et les rayons de l'arc.
- Maintenez votre casque et vos lunettes de protection en bon état. Remplacez toute lentille sale ou comportant fissure ou rognure.
- Protégez les autres personnes se trouvant sur la zone de travail contre les rayons de l'arc en fournissant des cabines ou des écrans de protection.

- Utilisez la nuance de lentille qui est suggérée dans le recommandation qui suivent ANSI/ASC Z49.1:

Courant Arc	Nuance Minimum Protective Numéro	Nuance Suggestée Numéro
Moins de 300*	8	9
300 - 400*	9	12
400 - 800*	10	14

** Ces valeurs s'appliquent ou l'arc actuel est observé clairement. L'expérience a démontré que les filtres moins foncés peuvent être utilisés quand l'arc est caché par moiceau de travail.*



BRUIT

Le bruit peut provoquer une perte permanente de l'ouïe. Les procédés de soudage à l'arc de plasma peuvent provoquer des niveaux sonores supérieurs aux limites normalement acceptables. Vous devez vous protéger les oreilles contre les bruits forts afin d'éviter une perte permanente de l'ouïe.

- Pour protéger votre ouïe contre les bruits forts, portez des tampons protecteurs et/ou des protections auriculaires. Protégez également les autres personnes se trouvant sur le lieu de travail.
- Il faut mesurer les niveaux sonores afin d'assurer que les décibels (le bruit) ne dépassent pas les niveaux sûrs.
- Pour des renseignements sur la manière de tester le bruit, consultez l'article 1, page 5.

1.06 Documents De Reference

Consultez les normes suivantes ou les révisions les plus récentes ayant été faites à celles-ci pour de plus amples renseignements :

1. OSHA, NORMES DE SÉCURITÉ DU TRAVAIL ET DE PROTECTION DE LA SANTÉ, 29CFR 1910, disponible auprès du Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
2. Norme ANSI Z49.1, LA SÉCURITÉ DES OPÉRATIONS DE COUPE ET DE SOUDAGE, disponible auprès de la Société Américaine de Soudage (American Welding Society), 550 N.W. LeJeune Rd., Miami, FL 33126
3. NIOSH, LA SÉCURITÉ ET LA SANTÉ LORS DES OPÉRATIONS DE COUPE ET DE SOUDAGE À L'ARC ET AU GAZ, disponible auprès du Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

4. Norme ANSI Z87.1, PRATIQUES SURES POUR LA PROTECTION DES YEUX ET DU VISAGE AU TRAVAIL ET DANS LES ECOLES, disponible de l'Institut Américain des Normes Nationales (American National Standards Institute), 1430 Broadway, New York, NY 10018
5. Norme ANSI Z41.1, NORMES POUR LES CHAUSSURES PROTECTRICES, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018
6. Norme ANSI Z49.2, PRÉVENTION DES INCENDIES LORS DE L'EMPLOI DE PROCÉDÉS DE COUPE ET DE SOUDAGE, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018
7. Norme A6.0 de l'Association Américaine du Soudage (AWS), LE SOUDAGE ET LA COUPE DE CONTENEURS AYANT RENFERMÉ DES PRODUITS COMBUSTIBLES, disponible auprès de la American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126
8. Norme 51 de l'Association Américaine pour la Protection contre les Incendies (NFPA), LES SYSTEMES À GAZ AVEC ALIMENTATION EN OXYGENE POUR LE SOUDAGE, LA COUPE ET LES PROCÉDÉS ASSOCIÉS, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
9. Norme 70 de la NFPA, CODE ELECTRIQUE NATIONAL, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
10. Norme 51B de la NFPA, LES PROCÉDÉS DE COUPE ET DE SOUDAGE, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
11. Brochure GCA P-1, LA MANIPULATION SANS RISQUE DES GAZ COMPRIMÉS EN CYLINDRES, disponible auprès de l'Association des Gaz Comprimés (Compressed Gas Association), 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202
12. Norme CSA W117.2, CODE DE SÉCURITÉ POUR LE SOUDAGE ET LA COUPE, disponible auprès de l'Association des Normes Canadiennes, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada, M9W 1R3
13. ivret NWSA, BIBLIOGRAPHIE SUR LA SÉCURITÉ DU SOUDAGE, disponible auprès de l'Association Nationale de Fournitures de Soudage (National Welding Supply Association), 1900 Arch Street, Philadelphia, PA 19103

14. Norme AWSF4.1 de l'Association Américaine de Soudage, RECOMMANDATIONS DE PRATIQUES SURES POUR LA PRÉPARATION À LA COUPE ET AU SOUDAGE DE CONTENEURS ET TUYAUX AYANT RENFERMÉ DES PRODUITS DANGEREUX, disponible auprès de la American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126
15. Norme ANSI Z88.2, PRATIQUES DE PROTECTION RESPIRATOIRE, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018

1.07 Declaration of Conformity

Manufacturer: Thermal Dynamics Corporation
Address: Industrial Park #2
West Lebanon, New Hampshire 03784
USA

The equipment described in this manual conforms to all applicable aspects and regulations of the 'Low Voltage Directive' (European Council Directive 73/23/EEC as amended by Council Directive 93/68/EEC) and to the National legislation for the enforcement of this Directive.

Serial numbers are unique with each individual piece of equipment and details description, parts used to manufacture a unit and date of manufacture.

National Standard and Technical Specifications

The product is designed and manufactured to a number of standards and technical requirements among them are:

- * CSA (Canadian Standards Association) standard C22.2 number 60 for Arc welding equipment.
- * UL (Underwriters Laboratory) rating 94VO flammability testing for all printed-circuit boards used.
- * ISO/IEC 60974-1 (BS 638-PT10) (EN 60 974-1) (EN50192) (EN50078) applicable to plasma cutting equipment and associated accessories.
- * Extensive product design verification is conducted at the manufacturing facility as part of the routine design and manufacturing process. This is to ensure the product is safe, when used according to instructions in this manual and related industry standards, and performs as specified. Rigorous testing is incorporated into the manufacturing process to ensure the manufactured product meets or exceeds all design specifications.

Thermal Dynamics has been manufacturing products for more than 30 years, and will continue to achieve excellence in our area of manufacture.

Manufacturers responsible representative: Steve Ward
Director of Operations
Thermadyne UK
Chorley England

1.08 Statement of Warranty

LIMITED WARRANTY: Thermal Dynamics® Corporation (hereinafter "Thermal") warrants that its products will be free of defects in workmanship or material. Should any failure to conform to this warranty appear within the time period applicable to the Thermal products as stated below, Thermal shall, upon notification thereof and substantiation that the product has been stored, installed, operated, and maintained in accordance with Thermal's specifications, instructions, recommendations and recognized standard industry practice, and not subject to misuse, repair, neglect, alteration, or accident, correct such defects by suitable repair or replacement, at Thermal's sole option, of any components or parts of the product determined by Thermal to be defective.

THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

LIMITATION OF LIABILITY: Thermal shall not under any circumstances be liable for special or consequential damages, such as, but not limited to, damage or loss of purchased or replacement goods, or claims of customers of distributor (hereinafter "Purchaser") for service interruption. The remedies of the Purchaser set forth herein are exclusive and the liability of Thermal with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale, delivery, resale, or use of any goods covered by or furnished by Thermal whether arising out of contract, negligence, strict tort, or under any warranty, or otherwise, shall not, except as expressly provided herein, exceed the price of the goods upon which such liability is based.

THIS WARRANTY BECOMES INVALID IF REPLACEMENT PARTS OR ACCESSORIES ARE USED WHICH MAY IMPAIR THE SAFETY OR PERFORMANCE OF ANY THERMAL PRODUCT.

THIS WARRANTY IS INVALID IF THE PRODUCT IS SOLD BY NON-AUTHORIZED PERSONS.

The limited warranty periods for Thermal products shall be as follows (with the exception of XL Plus Series, CutMaster 80XL, Cougar and DRAG-GUN): A maximum of three (3) years from date of sale to an authorized distributor and a maximum of two (2) years from date of sale by such distributor to the Purchaser, and with the further limitations on such two (2) year period (see chart below).

The limited warranty period for XL Plus Series and CutMaster 80XL shall be as follows: A maximum of four (4) years from date of sale to an authorized distributor and a maximum of three (3) years from date of sale by such distributor to the Purchaser, and with the further limitations on such three (3) year period (see chart below).

The limited warranty period for Cougar and DRAG-GUN shall be as follows: A maximum of two (2) years from date of sale to an authorized distributor and a maximum of one (1) year from date of sale by such distributor to the Purchaser, and with the further limitations on such two (2) year period (see chart below).

	Parts			
<u>PAK Units, Power Supplies</u>	<u>XL Plus Series & CutMaster 80XL</u>	<u>Parts Cougar/Drag-Gun</u>	<u>Parts All Others</u>	<u>Labor</u>
Main Power Magnetics	3 Years	1 Year	2 Years	1 Year
Original Main Power Rectifier	3 Years	1 Year	2 Years	1 Year
Control PC Board	3 Years	1 Year	2 Years	1 Year
All Other Circuits And Components Including, But Not Limited To, Starting Circuit, Contactors, Relays, Solenoids, Pumps, Power Switching Semi-Conductors	1 Year	1 Year	1 Year	1 Year
<u>Consoles, Control Equipment, Heat Exchanges, And Accessory Equipment</u>	1 Year		1 Year	1 Year
<u>Torch And Leads</u>				
Maximizer 300 Torch			1 Year	1 Year
All Other Torches	180 Days	180 Days	180 Days	180 Days
<u>Repair/Replacement Parts</u>	90 Days	90 Days	90 Days	None

Warranty repairs or replacement claims under this limited warranty must be submitted by an authorized Thermal Dynamics® repair facility within thirty (30) days of the repair. No transportation costs of any kind will be paid under this warranty. Transportation charges to send products to an authorized warranty repair facility shall be the responsibility of the customer. All returned goods shall be at the customer's risk and expense. This warranty supersedes all previous Thermal warranties.

Effective May 6, 1999

SECTION 2: INTRODUCTION & DESCRIPTION

2.01 Scope of Manual

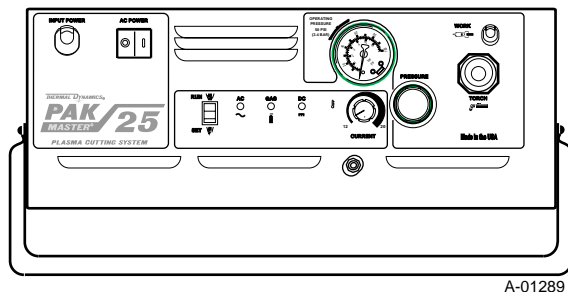
This manual contains descriptions, operating instructions and maintenance procedures for the Pak Master 25 Plasma Cutting System. Service of this equipment is restricted to properly trained personnel; unqualified personnel are strictly cautioned against attempting repairs or adjustments not covered in this manual, at the risk of voiding the Warranty.

Read this manual thoroughly. A complete understanding of the characteristics and capabilities of this equipment will assure the dependable operation for which it was designed.

2.02 General Description

The Pak Master 25 Air Plasma Cutting System Includes the following:

- PAK MASTER 25 - The power supply provides 20 amps maximum output cutting current from a standard 120 VAC, 60Hz input service. All electrical, pilot, and gas control circuitry is included.
- PCH-25 70° Hand Torch with 12.5 foot (3.8 m) Leads. Cut capacity is 1/4 inch (6.4 mm) steel. Parts-In-Place (PIP) is an integral safety feature of this torch to reduce the risk of electric shock.
- PCH-25 Torch Spare Parts Kit.
- 10 foot (3 m) Work Cable with Clamp.
- 6 foot (1.8 m) AC Input Power Cable with Molded Plug.



2.03 Specifications & Design Features


A. Pak Master 25 Power Supply

The following applies to the Pak Master 25 Power Supply only:

1. Controls

- AC POWER on/off Switch
- RUN/SET Switch
- CURRENT Output Control
- PRESSURE Regulator Control With Pressure Gauge

2. Panel LED Indicators

AC, GAS, DC,  (temperature)

3. Input Power

120 VAC ($\pm 10\%$), 60 Hz, 20 Amp Single Phase

4. Output Power

Continuously variable from 12 to 20 Amps maximum

5. OCV

375 VDC

6. Duty Cycle

40%

7. Work Lead

10 ft (3 m) with clamp

8. Cut Capacity

1/4 inch (6.4 mm) Steel

9. Pilot Circuitry

Capacitor Discharge (CD), Pulsed DC

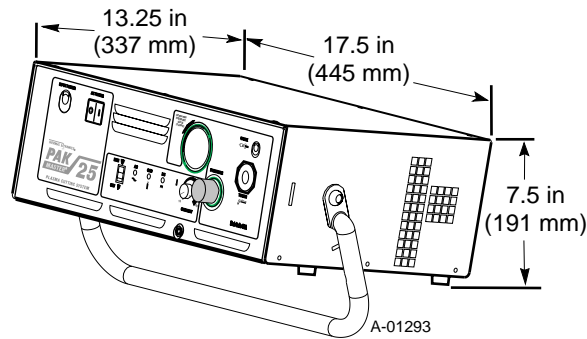
10. Gas Connection

Front panel entry 1/4 NPT

11. Weight

42.5 lbs (19.3 kg)

12. Power Supply Dimensions



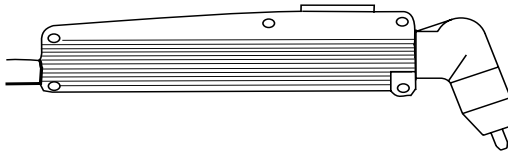
B. PCH-25 Torch

The following applies to the PCH-25 Torch only:

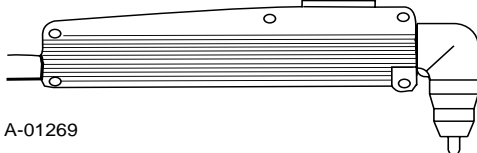
1. PCH-25 Torch Configuration

The PCH-25 Torch is available only in 70° or 90° Hand Torch configurations.

70° Hand Torches



90° Hand Torches



2. Torch Leads Length

12.5 ft (3.8 m)

25 ft (7.6 m)

3. Current Rating

20 Amps Max., DC, Straight Polarity

4. Duty Cycle

100%

5. Cutting Range

Most materials up to 1/4 inch (6.4 mm)

6. Pierce Rating

1/8 inch (3.2 mm)

7. Transfer Distance

1/8 inch (3.2 mm)

8. Torch Parts

Gas Distributor, Electrode, Tip, Shield Cup

9. Gas Requirements

CAUTION

Air supply must be free of oil, moisture, and other contaminants. Excessive oil and moisture may cause double-arcing, rapid tip wear, or even complete torch failure. Contaminants may cause poor cutting performance and rapid electrode wear.

a. Type Gas

Compressed Air or Nitrogen (N₂) Only



WARNING

This cutting system must not be used with Oxygen (O₂).

b. Pressure

50 psi (3.5 BAR)

CAUTION

Maximum input gas pressure must not exceed 125 psi (8.6 BAR)

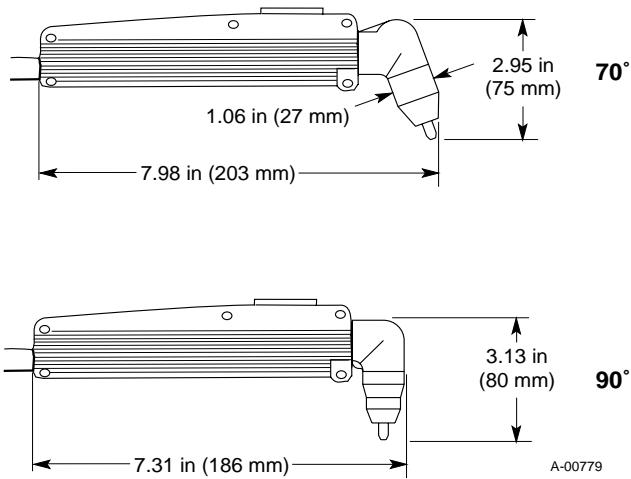
c. Flow

125 scfh (59 lpm)

10. Weight (without leads)

1.0 lb (.45 kg)

11. Torch Dimensions



2.04 Options And Accessories

These items can be used to customize a standard system for a particular application or to further enhance performance (refer to Section 6 for ordering information).

- Circle Cutting Attachments

This device provides precise cutting capability with a hand torch. The guide fits 70° and 90° hand torches. The kit includes roller guides and pivots that attach to the torch.

- Leads Storage Kit

Provides a place to store the Pak Master 25 Torch Leads and is designed to be mounted on the top of the Pak Master 25 Power Supply.

- Air Line Filter

Removes damaging contaminants and moisture from the air stream when using compressed air.

SECTION 3: INSTALLATION PROCEDURES

3.01 Introduction

This Section describes installation of the Pak Master 25 Plasma Cutting System. These instructions apply to the Power Supply, Torch and Leads Assemblies only; installation procedures for the Options and Accessories are given in Manuals specifically provided for those units.

The complete installation consists of:

1. Site Selection
2. Unpacking
3. Electrical Connection
4. Gas Connections
5. Operator Training

3.02 Site Location

Select a clean, dry location with good ventilation and adequate working space around all components.

CAUTIONS

Operation without proper air flow will inhibit proper cooling and reduce duty cycle.

To prevent entry of cutting or other metal debris, the power supply must not be operated in the vertical position. Operate the power supply in the horizontal position or propped up by the handle.

The power supply is cooled by air flow through the front and side panels. Air flow must not be obstructed. Provide at least 12 inches (300 mm) clearance on each side. Provide sufficient clearance in front of the unit to allow access to front panel controls (minimum 12 inches or 300 mm).

NOTE

Review the safety precautions in the front of this manual to be sure that the location meets all safety requirements.

3.03 Unpacking

The system is packaged with a carton and packing material to prevent damage during shipping.

A. System Components

Included with each system is the following:

- (1) Power Supply with the following installed:
 - PCH-25 Torch and Leads (1 each)
 - Work Cable with Clamp attached (1 each)
 - 120VAC Single-Phase Input Power Cable with Plug attached (1 each)
- (1) Instruction Manual
- (1) Spare Parts Kit - Includes:
 - Standard Tips (5 each)
 - Electrodes (3 each)
 - Gas Distributor (1 each)

B. Unpacking Procedure

1. Unpack each item and remove all packing material.
2. Locate the packing list(s) and use the list to identify and account for each item.
3. Inspect each item for possible shipping damage. If damage is evident, contact your distributor and/or shipping company before proceeding with system installation.

3.04 Electrical Connection

A. Power Requirements

The unit will operate on single phase 120VAC $\pm 10\%$, 60 Hz. The service must be fused for at least 20 amps. A 15 amp circuit is insufficient for proper system operation.

B. Extension Cords

Extension cords must meet National Electric Code guidelines. Extension cords must be rated for at least 20 amps and must have three-prong plugs. Refer to the following table for recommended cord sizes:

Extension Cord Wire Gauge Requirements	
Cord Length	Wire Gauge
50 ft (15.2 m) or less	12 gauge
100 ft (30.5 m)	10 gauge
150 ft (45.7 m)	8 gauge

3.05 Gas Connection

CAUTION

Maximum input gas pressure must not exceed 125 psi (8.6 BAR)

This sub-section includes information for connecting the gas supply to the Power Supply. The information is grouped in paragraphs for different type gases and options per the following:

A. Using Shop Air

B. Using High-Pressure Gas Cylinders

Refer to the appropriate paragraph(s) for the desired application to be used.

A. Using Shop Air

An air line filter, capable of filtering to at least 5 microns, is required when using air from a compressor to insure that moisture and debris from the supply hose does not enter the torch.

CAUTION

Air supply must be free of oil, moisture, and other contaminants. Excessive oil and moisture may cause double-arcing, rapid tip wear, or even complete torch failure. Contaminants may cause poor cutting performance and rapid electrode wear.

Install the Optional Air Line Filter and connect the gas supply per the following procedure:

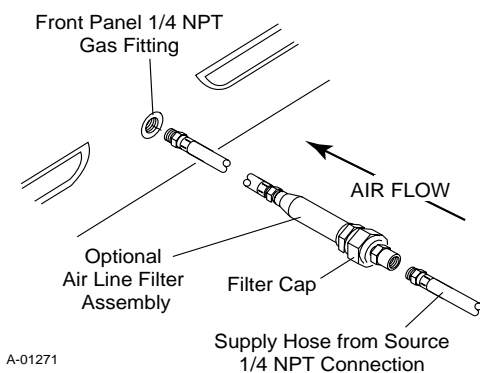


Figure 3-1 Shop Air Gas Connection

NOTE

DO NOT use teflon tape on gas fittings.

1. Connect the air line filter assembly to the female 1/4 NPT gas input fitting at the front panel of the power supply. The air filter is supplied with 1/4 NPT gas couplings. A quick disconnect fitting is recommended on the filter body cap to allow easy connection to the compressed air source.
2. Connect the air supply hose to the inlet fitting on the air line filter body cap.

CAUTION

When connecting a gas fitting to the filter cap, hold the cap flats with a wrench. Over tightening the cap on the filter body can damage the filter cartridge or cap gasket.

B. Using High Pressure Gas Cylinders

NOTE

Do not use an air line filter with high pressure gas cylinders.

To use air or nitrogen from a high pressure gas cylinder:

1. Connect the gas supply hose to the female 1/4 NPT gas input fitting at the front panel of the power supply.

NOTE

DO NOT use teflon tape on gas fittings.

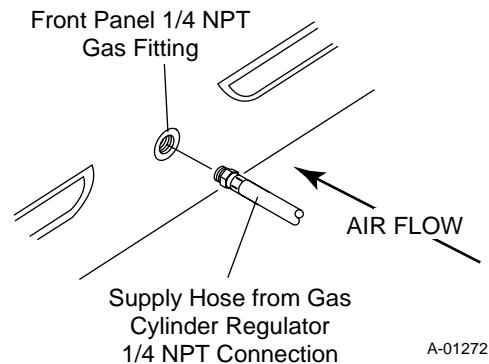


Figure 3-2 High Pressure Gas Cylinder Connection

2. Examine the cylinder valves to be sure they are clean and free of oil, grease or any foreign material. Momentarily open each cylinder valve to blow out any dust which may be present.
3. Each cylinder must be equipped with an adjustable high-pressure regulator capable of pressures up to 75 psi (5.3 BAR) minimum and flows of up to 200 scfh (94 lpm).

NOTE

Refer to the manufacturer's specifications for installation and maintenance procedures for high pressure gas regulators.

4. Connect the gas supply hose to the high-pressure regulator at the gas cylinder.
5. Set the tank regulator to 75 psi (5.3 BAR). Use the regulator on the front of the power supply to adjust the gas pressure to the unit.

SECTION 4: OPERATION

4.01 Introduction

This Section provides a description of the Pak Master 25 Plasma Cutting System followed by operating procedures.

4.02 Functional Overview

The Pak Master 25 Plasma Cutting System is designed to provide a plasma cutting system which can cut most metals from gauge thickness up to 1/4 inch (6.4 mm).

4.03 Operating Controls

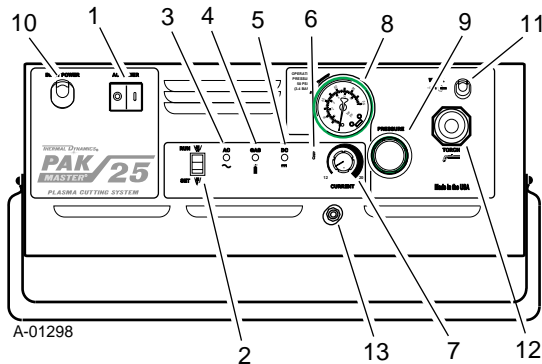


Figure 4-1 Front Panel Controls and Indicators

1. AC POWER ON/OFF Switch

ON position supplies AC power to activate all system control circuits. OFF position deactivates control circuits.

2. RUN/SET Switch

RUN position is used for torch operation. SET position is used for setting gas pressure and purging lines.

3. AC Indicator

Yellow light indicates AC input power is present in the system when the ON/OFF switch is in ON position. Indicator will flash for a few seconds when first turned on until the power circuits are ready.

4. GAS Indicator

Yellow light (with RUN/SET switch in SET position) indicates minimum gas pressure (35 psi or 2.5 BAR) flowing to the torch. Light goes out in RUN position until torch is activated.

5. DC Indicator

Yellow light indicates adequate DC power output for main arc when the torch is activated.

6. (Temperature) Indicator

No symbol is visible during normal operation. The presence of a thermometer symbol indicates overheating; unit must be allowed to cool. The indicator will also flash for a moment if the torch is shorted.

7. CURRENT Control

Adjusts output current from 12 to 20 amps.

8. Pressure Gauge

Displays input gas pressure to the torch.

9. PRESSURE Control

Adjusts gas pressure from the regulator. Pull knob out and turn clockwise to increase gas pressure to desired level. Push Knob in to lock setting.

10. Input Power Cable

Strain relief and input power cable for main AC power to the unit.

11. WORK Cable Input

Input for the work cable on the system.

12. TORCH Cable Input

Input for interfacing the Torch to the Power Supply.

13. Gas Input Fitting

Input gas fitting to connect the desired gas to the Power Supply.

4.04 Getting Started

This procedure should be followed at the beginning of each shift:



WARNING

Disconnect primary power at the source before assembling or disassembling power supply, torch parts, or torch and leads assemblies.

A. Torch Parts

Check the torch for proper assembly. Install proper torch parts for the desired application (refer to Section 4.05, Torch Consumable Parts Selection).

NOTE

The power supply will not operate unless the torch shield cup is fully seated against the PIP (Parts in Place) pins in the torch head.

B. Input Power

1. Check the power source for proper input voltage.
2. Make sure the power source meets circuit protection and wiring requirements per Section 3.04.
3. Plug unit in and close main disconnect switch to supply primary power to the system.

C. Work Cable

Check for a solid work cable connection to the workpiece.

D. Gas Supply

Select desired gas supply, air or nitrogen (N₂). Make sure gas source meets the gas requirements (refer to Section 2.03, Specifications & Design Features). Check connections and turn gas supply on.

E. Purge System

On the Power Supply place the ON/OFF switch to the ON position. An automatic gas purge (pre-flow) will remove any condensation that may have accumulated in the torch and leads while the system was shut down. The torch cannot be activated during the purge cycle (pre-flow). After the purge is complete, if the RUN/SET switch is in SET position, gas will flow. If the switch is in the RUN position there will be no gas flow.

F. Checking Air Quality

To check the quality of the air, place a welding filter lens in front of the torch and turn on the gas supply (set the RUN/SET switch to SET). Any oil or moisture in the air will be visible on the lens. Do not initiate an arc!

G. Current Output Level

At the Power Supply set the desired current output level for the desired operation (12 to 20 amps).

NOTE

DO NOT exceed the amperage rating of the Torch Parts (consumables).

H. Pressure Settings

NOTES

Refer to Appendix II, Cutting Speed Charts, for recommended gas pressure for the material being cut.

Place the RUN/SET switch to the SET position. Adjust gas PRESSURE control to 50 psi (3.5 BAR).

I. Ready for Operation

Return the RUN/SET switch to RUN position.

The system is now ready for operation.

NOTE

Refer to Appendix I for a detailed block diagram of the Sequence Of Operation.

4.05 Torch Consumable Parts Selection

The same torch parts are used for drag or standoff cutting. Refer to Figure 4-2 for the various torch parts.

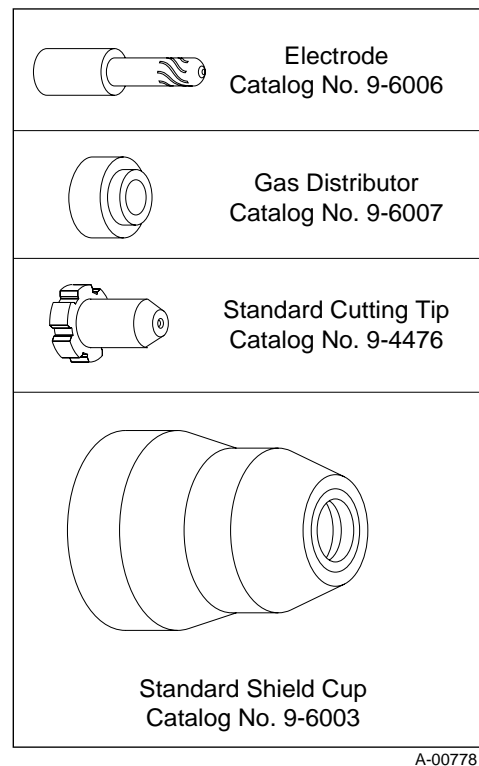


Figure 4-2 Torch Consumable Parts Selection

To change the torch consumable parts use the following procedure:

NOTE

The tip, gas distributor, and electrode are held in place by the shield cup. Position the torch with the shield cup facing upward to prevent these parts from falling out when the cup is removed.

1. Unscrew and remove the shield cup from the Torch Head Assembly.

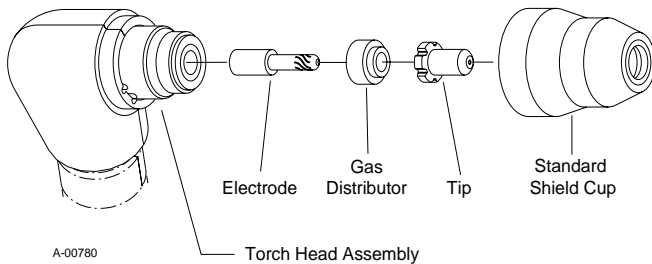


Figure 4-3 Consumable Parts

3. Remove the tip, gas distributor, and electrode.

NOTE

The tip, electrode and gas distributor have o-rings on each part. The o-rings should be removed and a light coating of o-ring lubricant (catalog number 8-4025) applied.

6. Install the electrode, gas distributor, and tip.
7. Hand tighten the shield cup until it is seated on the torch head. If resistance is felt when installing the cup, check the threads before proceeding.

CAUTION

Improper assembly or use of non standard torch parts can cause the torch head to short and may overheat or damage the torch.

4.06 Cut Quality

NOTE

Cut quality depends heavily on set-up and parameters such as torch standoff, alignment with the workpiece, cutting speed, gas pressures, and operator ability.

Cut quality requirements differ depending on application. For instance, nitride build-up and bevel angle may be major factors when the surface will be welded after cutting. Dross-free cutting is important when finish cut quality is desired to avoid a secondary cleaning operation. The following cut quality characteristics are illustrated in Figure 4-4:

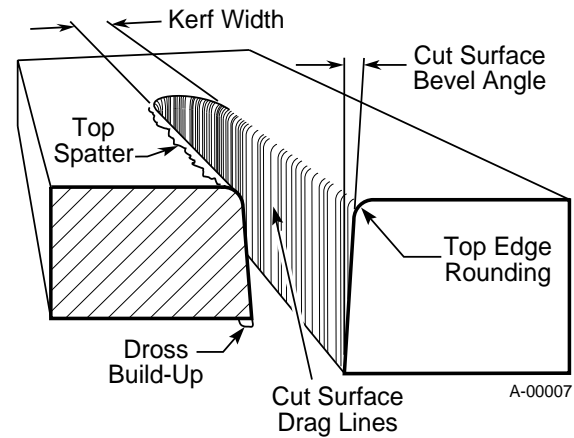


Figure 4-4 Cut Quality Characteristics

A. Cut Surface

The desired or specified condition (smooth or rough) of the face of the cut.

B. Nitride Build-Up

Nitride deposits can be left on the surface of the cut when nitrogen is present in the plasma gas stream. These buildups may create difficulties if the material is to be welded after the cutting process.

C. Bevel Angle

The angle between the surface of the cut edge and a plane perpendicular to the surface of the plate. A perfectly perpendicular cut would result in a 0° bevel angle.

D. Top-Edge Rounding

Rounding on the top edge of a cut due to wearing from the initial contact of the plasma arc on the workpiece.

E. Bottom Dross Build-up

Molten material which is not blown out of the cut area and re-solidifies on the plate. Excessive dross may require secondary clean-up operations after cutting.

F. Kerf Width

The width of the cut (or the width of material removed during the cut).

G. Top Spatter (Dross)

Top Spatter or dross on the top of the cut caused by slow travel speed, excess cutting height, or cutting tip whose orifice has become elongated. Excessive dross may require secondary clean-up operations after cutting.

H. Various Materials and Thicknesses

The following table defines the cut quality on various materials and thicknesses:

Cut Quality on Various Materials				
Type Gas	Material Thickness	Type of Material		
		Carbon Steel	Stainless	Aluminum
Air or Nitrogen (N ₂)	Gage to 1/4 inch (6.4 mm)	Good - Excellent	Good - Excellent	Good - Excellent
	(Aluminum to 3/16 inch (4.8 mm))	Good	Good	Good

Description of Cut Characteristics:

Excellent - Minimum bevel (0 - 4°), minimum kerf (2 x tip orifice diameter), little or no dross, smooth cut surface.

Good - Slight bevel (0 - 10°), slightly wider kerf (2-1/2 x tip orifice diameter), some dross (easily removed), medium-smooth cut surface, slight top edge rounding.

NOTE

Cut quality depends heavily on set-up and parameters such as torch standoff, alignment with the workpiece, cutting speed, gas pressures, and operator ability.

4.07 Operating the System



WARNINGS

Disconnect primary power at the source before disassembling the power supply, torch, or torch leads.

Frequently review the Important Safety Precautions at the front of this manual. Be sure the operator is equipped with proper gloves, clothing, eye and ear protection. Make sure no part of the operator's body comes into contact with the workpiece while the torch is activated.

CAUTION

Sparks from the cutting process can cause damage to coated, painted, and other surfaces such as glass, plastic and metal.

NOTE

Handle torch leads with care and protect them from damage.

A. Piloting

Piloting is harder on parts life than actual cutting because the pilot arc is directed from the electrode to the tip rather than to a workpiece. Whenever possible, avoid excessive pilot arc time to improve parts life.

B. Torch Standoff

Improper standoff (the distance between the torch tip and workpiece) can adversely affect tip life as well as shield cup life. Standoff may also significantly affect the bevel angle. Reducing standoff will generally result in a reduced bevel angle.

C. Edge Starting

NOTE

Edge starting is not recommended for machine type operations as most of the operations use the stand-off method of starting and finishing on the work piece.

For edge starts, hold the torch perpendicular to the workpiece with the front of the tip near(not touching) the edge of the workpiece at the point where the cut is to start. When starting at the edge of the plate, do not pause at the edge and force the arc to "reach" for the edge of the metal. This effect will cause reduced tip life. Establish the cutting arc as quickly as possible.

D. Direction of Cut

In the Torch, the plasma gas stream swirls as it leaves the torch to maintain a smooth column of gas. This swirl effect results in one side of a cut being more square than the other. Viewed along the direction of travel, the right side of the cut is more square than the left (Refer to Figure 4-5). To make a square-edged cut along an inside diameter of a circle, the torch should move counterclockwise around the circle. To keep the square edge along an outside diameter cut, the torch should travel in a clockwise direction.

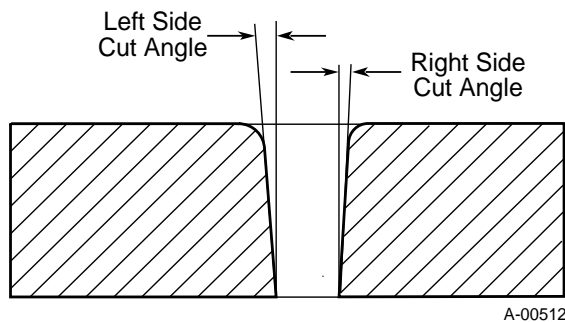


Figure 4-5 Side Characteristics Of Cut

E. Dross

When dross is present on carbon steel, it is commonly referred to as either "high speed, slow speed, or top dross". Dross present on top of the plate is normally caused by too great a torch to plate distance. "Top dross" is normally very easy to remove and can often be wiped off with a welding glove. "Slow speed dross" is normally present on the bottom edge of the plate. It can vary from a light to heavy bead, but does not adhere tightly to the cut edge, and can be easily scraped off. "High speed dross" usually forms a narrow bead along the bottom of the cut edge and is very difficult to remove. When cutting a troublesome steel, it is sometimes useful to reduce the cutting speed to produce "slow speed dross". Any resultant cleanup can be accomplished by scraping, not grinding.

4.08 Hand Torch Operation

A. Cutting with a Hand Torch

1. The torch can be comfortably held in one hand or steadied with two hands. Choose the technique that feels most comfortable and allows good control and movement. Position the index finger or thumb to press the control switch on the torch handle.
2. For edge starts, hold the torch perpendicular to the workpiece with the front of the tip on the edge of the workpiece at the point where the cut is to start. For piercing, angle the torch slightly to direct sparks away from the torch until the pierce is complete.
3. For drag cuts keep the torch in contact with the workpiece. For standoff cutting, hold the torch 1/16 - 1/8 in (2-3 mm) from the work.
4. With the torch in starting position, press and hold the control switch. After an initial gas purge, the pilot arc will come on and remain on until the cutting arc starts.

5. Once on, the main arc remains on as long as the control switch is held down, unless the torch is withdrawn from the work or torch motion is too slow. If the cutting arc is interrupted, the pilot arc comes back on automatically.
6. To shut off the torch simply release the control switch. When the switch is released a post-flow will occur. If the torch switch is closed during the post-flow, the cutting arc will restart immediately when the torch is brought within range of the workpiece.

B. Piercing with a Hand Torch

1. When piercing with a hand torch, tip the torch slightly so that blowback particles blow away from the torch tip (and operator) rather than directly back into it.
2. Complete the pierce off the cutting line and then continue the cut onto the line. Hold the torch perpendicular to the workpiece after the pierce is complete.
3. Clean spatter and scale from the shield cup and the tip as soon as possible. Spraying or dipping the shield cup in anti-spatter compound will minimize the amount of scale which adheres to it.

4.09 Recommended Cutting Speeds

Cutting speed depends on material, thickness, and the operator's ability to accurately follow the desired cut line. The following factors may have an impact on system performance:

- Torch parts wear
- Air quality
- Operator experience
- Torch standoff height
- Proper work cable connection
- Alloy content of material

NOTE

This information represents realistic expectations using recommended practices and well-maintained systems. Actual speeds may vary from those shown in the charts depending on the alloy content of the selected material.

For complete cutting speed chart data refer to Appendix II.

SECTION 5: CUSTOMER/OPERATOR SERVICE

5.01 Introduction

This Section describes basic maintenance procedures performable by operating personnel and advanced procedures for properly trained personnel. No other adjustments or repairs are to be attempted by other than properly trained personnel.



WARNINGS

Disconnect primary power at the source before disassembling the torch or torch leads.

Frequently review the Important Safety Precautions at the front of this Manual. Be sure the operator is equipped with proper gloves, clothing, eye and ear protection. Make sure no part of the operator's body comes into contact with the work-piece while the torch is activated.

CAUTION

Sparks from the cutting process can cause damage to coated, painted, and other surfaces such as glass, plastic and metal.

NOTE

Handle torch leads with care and protect them from damage.

5.02 General Maintenance

A. Cleaning Power Supply

The only routine maintenance required for the power supply is a thorough cleaning and inspection, with the frequency depending on the usage and the operating environment.



WARNING

Disconnect primary power to the system before disassembling the torch, leads, or power supply.

CAUTION

Do not blow air into the power supply during cleaning. Blowing air into the unit can cause metal particles to interfere with sensitive electrical components and cause damage to the unit.

To clean the unit, open the enclosure (refer to Section 5.11-A, Opening Enclosure) and use a vacuum cleaner to remove any accumulated dirt and dust. The unit should also be wiped clean. If necessary, solvents that are recommended for cleaning electrical apparatus may be used.

CAUTION

When cleaning care must be taken not to move or damage the electronic components.

B. Optional Single Stage In-Line Air Filter

NOTE

Refer to Section 6, Parts Lists, for replacement parts and ordering information.

The Optional Single Stage In-Line Air Filter cartridge should be replaced every 30 days, depending on the condition of the compressed air. If a noticeable drop in air pressure occurs, the filter may have become filled with contaminants and must be replaced.

Replace the cartridge per the following procedure:

1. Unscrew the filter cap from filter body.
2. Slide the old cartridge out of the filter body.
3. Insert the new filter cartridge into the filter body.
The filter cartridge will go in only one way.
4. Reinstall the filter cap and only hand tighten.

NOTE

Supply hoses must be at least #4 hose (1/4 inch or 6.4 mm minimum inside diameter).

C. Cleaning Torch



WARNINGS

Disconnect primary power to the system before disassembling the torch, leads, or power supply.

DO NOT touch any internal torch parts while the AC indicator light on the front panel of the power supply is ON.

Even if precautions are taken to use only clean air with a torch, eventually the inside of the torch becomes coated with residue. This buildup can affect the pilot arc initiation and the overall cut quality of the torch.

The inside of the torch should be cleaned with electrical contact cleaner using a cotton swab or soft wet rag. In severe cases, the torch can be removed from the leads (refer to Section 5.13, Servicing Torch Head Components) and cleaned more thoroughly by pouring electrical contact cleaner into the torch and blowing it through with compressed air.

CAUTION

Dry the torch thoroughly before reinstalling.

5.03 Common Operating Faults

The following lists the more common cutting faults and what is the possible cause:

1. Insufficient Penetration

- Cutting speed too fast*
- Torch tilted too much*
- Metal too thick*
- Worn torch parts*
- Cutting current too low*
- Non-Genuine Thermal Dynamics Parts*

2. Main Arc Extinguishes

- Cutting speed too slow*
- Torch standoff too high from workpiece*
- Cutting current too high*
- AC line too low - reduce output current*
- Work cable disconnected*
- Worn torch parts*
- Non-Genuine Thermal Dynamics Parts*

3. Excessive Dross Formation

- Cutting speed too slow (bottom dross)*
- Cutting speed too fast (top dross)*
- Torch standoff too high from workpiece*
- Worn torch parts*
- Improper cutting current*
- Non-Genuine Thermal Dynamics Parts*

4. Short Torch Parts Life

- Oil or moisture in air source*
- Exceeding system capability (material too thick)*
- Excessive pilot arc time*
- Air flow too low (incorrect pressure)*
- Improperly assembled torch*
- Output current too high*
- Torch tip contacting workpiece*
- Damaged or loose torch head components*
- Non-Genuine Thermal Dynamics Parts*

5. Poor Pilot Starting

- Non-Genuine Thermal Dynamics Parts*

5.04 Inspection and Replacement Consumable Torch Parts



WARNINGS

Disconnect primary power to the system before disassembling the torch or torch leads.

DO NOT touch any internal torch parts while the AC indicator light on the front panel of the Power Supply is ON.

Remove the consumable torch parts per the following procedure:

NOTE

The tip, gas distributor, and electrode are held in place by the shield cup. Position the torch with the shield cup facing upward to prevent these parts from falling out when the cup is removed.

1. Unscrew and remove the shield cup from the torch.

NOTE

Slag built up on the shield cup that cannot be removed may effect the performance of the system.

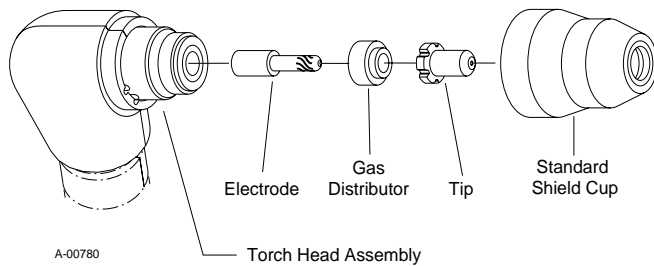


Figure 5-1 Consumable Parts

2. Inspect the cup for damage. Wipe it clean or replace if damaged.
3. Remove the tip. Check for excessive wear (indicated by an elongated or oversized orifice). Replace the tip if necessary.

NOTE

The tip, electrode and gas distributor have o-rings on each part. The o-rings should be removed and a light coating of o-ring lubricant (catalog number 8-4025) applied.

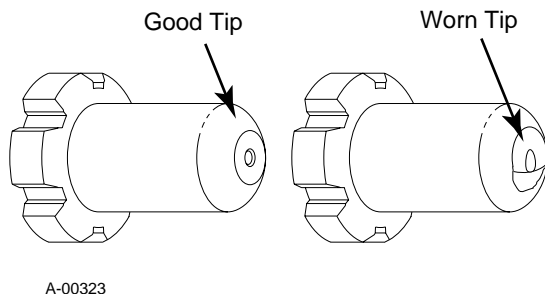


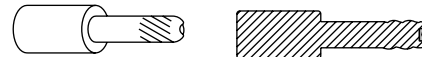
Figure 5-2 Tip Wear

4. Remove the gas distributor. Check for excessive wear, plugged gas slots, or discoloration. Replace if necessary.
5. Remove the electrode. Refer to Figure 5-3 and check the face of the electrode for excessive wear. The face of the electrode should not be recessed more than 0.10 inch (2.5 mm). If it is worn beyond this point it must be replaced.

New Electrode



Worn Electrode



A-01270

Figure 5-3 Electrode Wear

6. Install the electrode, gas distributor, tip and shield cup.
7. Hand tighten the shield cup until it is seated on the torch head. If resistance is felt when installing the cup, check the threads before proceeding.

CAUTION

Improper assembly or use of non standard torch parts can cause the torch head to short and may overheat or damage the torch.

5.05 Troubleshooting Guides

There are two Troubleshooting Guides, Basic and Advanced, provided in this Instruction Manual. The Basic Troubleshooting Guide uses symptom, cause, and remedy for fault isolation. The Advanced Troubleshooting Guide uses Flow Charts and test procedures for fault isolation.

Basic troubleshooting is limited to non-power checks and external Power Supply faults. Advanced troubleshooting requires fault isolation to the Power Supply or Torch, Power Supply disassembly, voltage measurements and major component replacement.

The guides are as follows:

Section 5.06 - Basic Troubleshooting Guide

Section 5.07 - Advanced Troubleshooting Guide

Depending on the level of repair to be done, refer to the desired troubleshooting guide.

5.06 Basic Troubleshooting Guide

A. General

Basic troubleshooting of the Pak Master 25 plasma cutting system can be performed without special equipment or knowledge, and without opening the enclosure.

This basic troubleshooting guide covers input power, gas supply, and torch problems.

For problems not covered here, refer to the Advanced Troubleshooting Guide or contact your authorized Thermal Dynamics distributor.

If a Thermal Dynamics product must be returned for service, contact your Thermal Dynamics distributor. Materials returned to Thermal Dynamics without proper authorization will not be accepted.

B. How to use this Guide

The following information is a guide to help determine the most likely causes for various symptoms.

This guide is set up in the following manner:

X. Symptom (Bold Type)

Any Special Instructions (Text Type)

1. Cause (Italic Type)

a. Check/Remedy (Text Type)

Locate your **symptom**, check the *causes* (easiest listed first) then remedies. Repair as needed being sure to verify that the unit is fully operational after any repairs.

A. AC indicator OFF, Fan does not operate.

1. Circuit Breaker open.

a. Reset Breaker. Use 20 amp or greater service.

B. AC indicator ON, (temperature) indicator ON.

1. Unit is overheated.

a. Make sure the unit has not been operated beyond 40% duty cycle limit.

2. Airflow obstructed.

a. Provide at least 12 inch clearance on each side.

3. Pilot circuit overheated. Temp indicator lights momentarily and unit shuts down.

a. Check for proper torch parts assembly per Section 5.04, or for shorted torch head per Section 5.10.

C. AC indicator ON, (temperature) indicator dark, no gas flow in SET.

1. Gas not connected or pressure too low.

a. Check source for at least 50 psi (3.5 BAR). In SET position, adjust gas pressure to 50 psi.

2. Air filter or air line blocked (GAS indicator dark). Torch leads blocked (GAS indicator lit).

a. Replace filter cartridge. Check that air lines and torch leads are free of twists and kinks.

D. AC indicator ON, (temperature) indicator dark, no gas flow in RUN when torch switch pressed.

1. Shield cup not properly installed on torch.

a. Check that shield cup is fully seated against torch head.

2. Faulty Torch Switch or PIP Assembly in torch holder.

a. Refer to Servicing Torch Head Components, Section 5.13.

3. Faulty Main PC Board

a. Repair/Replace Power Supply

E. AC indicator ON, (temperature) indicator dark, GAS indicator ON, gas flows, DC indicator ON. Torch does not pilot.

1. Faulty torch parts

a. Inspect torch parts and replace if necessary per Section 5.04.

2. Gas pressure too high.

a. Set pressure to 50 psi (3.5 BAR).

F. Torch pilots but does not cut.

1. Work lead not connected.

a. Make sure work lead is connected securely to bare metal.

2. AC input power too low

a. Use shorest service to breaker panel possible. Follow extension cord recommendations per Section 3.04.

5.07 Advanced Troubleshooting Guide

A. General

The troubleshooting covered in this Instruction Manual requires Power Supply disassembly and live measurements. It is helpful for solving the common problems that may arise with the Power Supply Assembly.



WARNING

There are extremely dangerous voltage and power levels present inside this unit. Do not attempt to diagnose or repair unless you have had training in power electronics measurement and troubleshooting techniques.

If major complex subassemblies are faulty, the assembly must be returned to an authorized service center for repair.

Follow all instructions as listed and complete each in the order presented.

The guide has two sections as follows:

Section 5.08 - Troubleshooting Flow Charts

Section 5.09 - Test Procedures

Specific test procedures have been grouped together, and are referenced by the flowcharts.

B. How to use this Guide

The following information is a guide to help the Service Technician determine the most likely causes for various failures. This guide is set up in the following manner:

1. Use flowchart(s) to isolate problem to possible circuit(s).
2. Perform the test procedures as required as noted on flowcharts.
4. Repair as needed being sure to verify that unit is fully operational after any repairs.

5.08 Troubleshooting Flow Charts

The following pages are flow charts to be used to isolate problems in the Plasma Cutting System.

Chart #1: Main Power

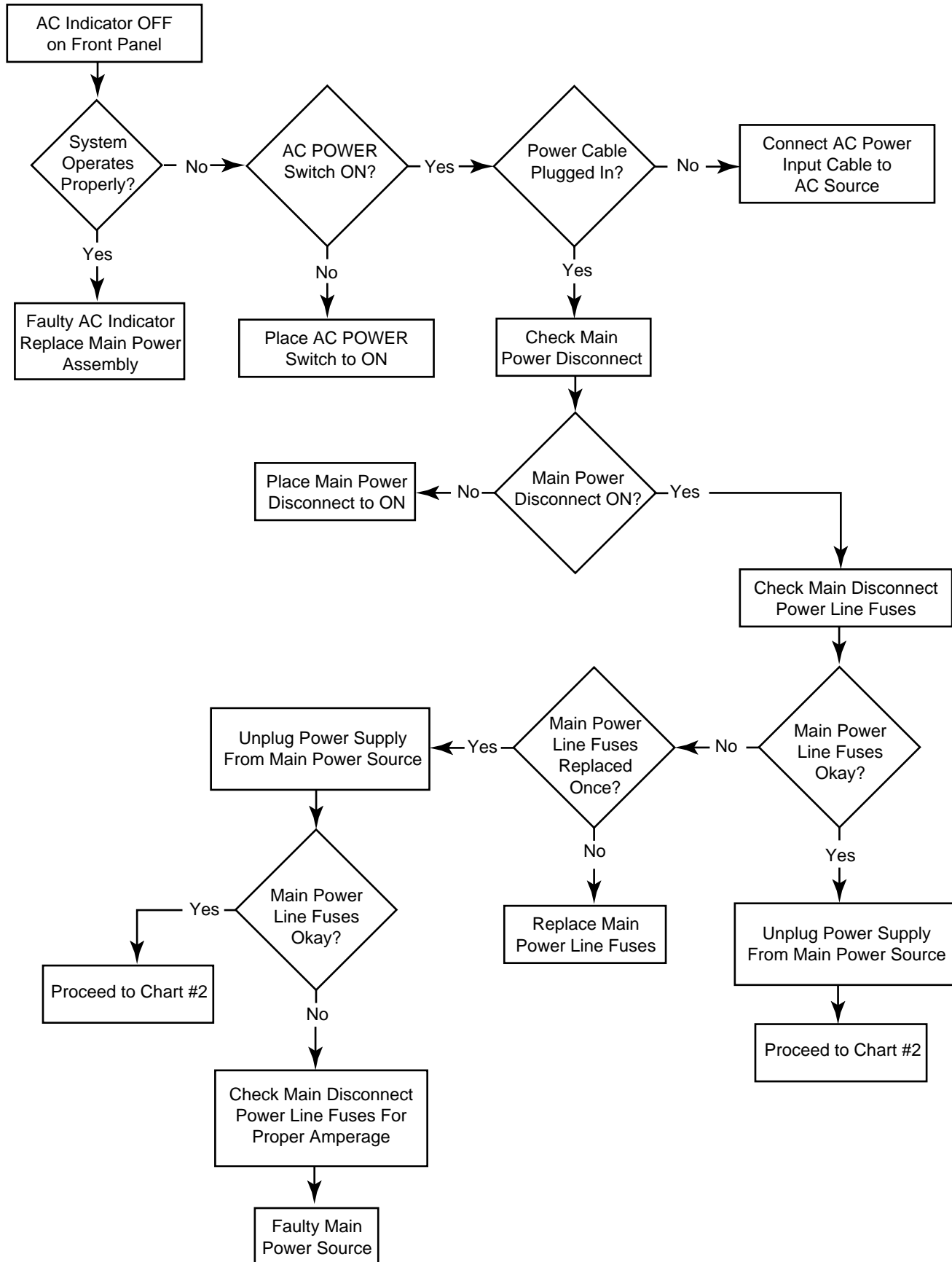


Chart #2: Input Power Checks

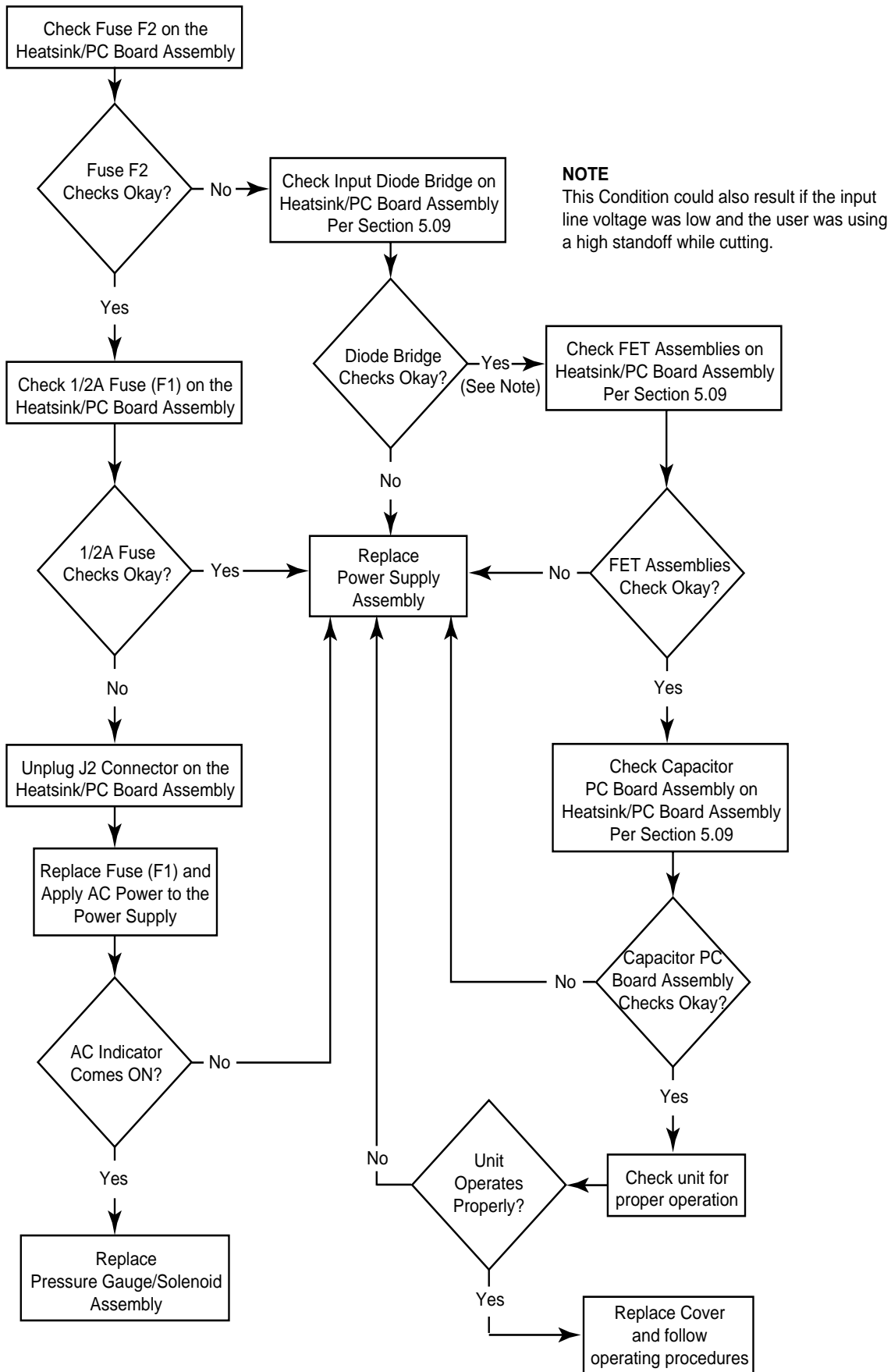


Chart #3: Temperature Indicator Checks

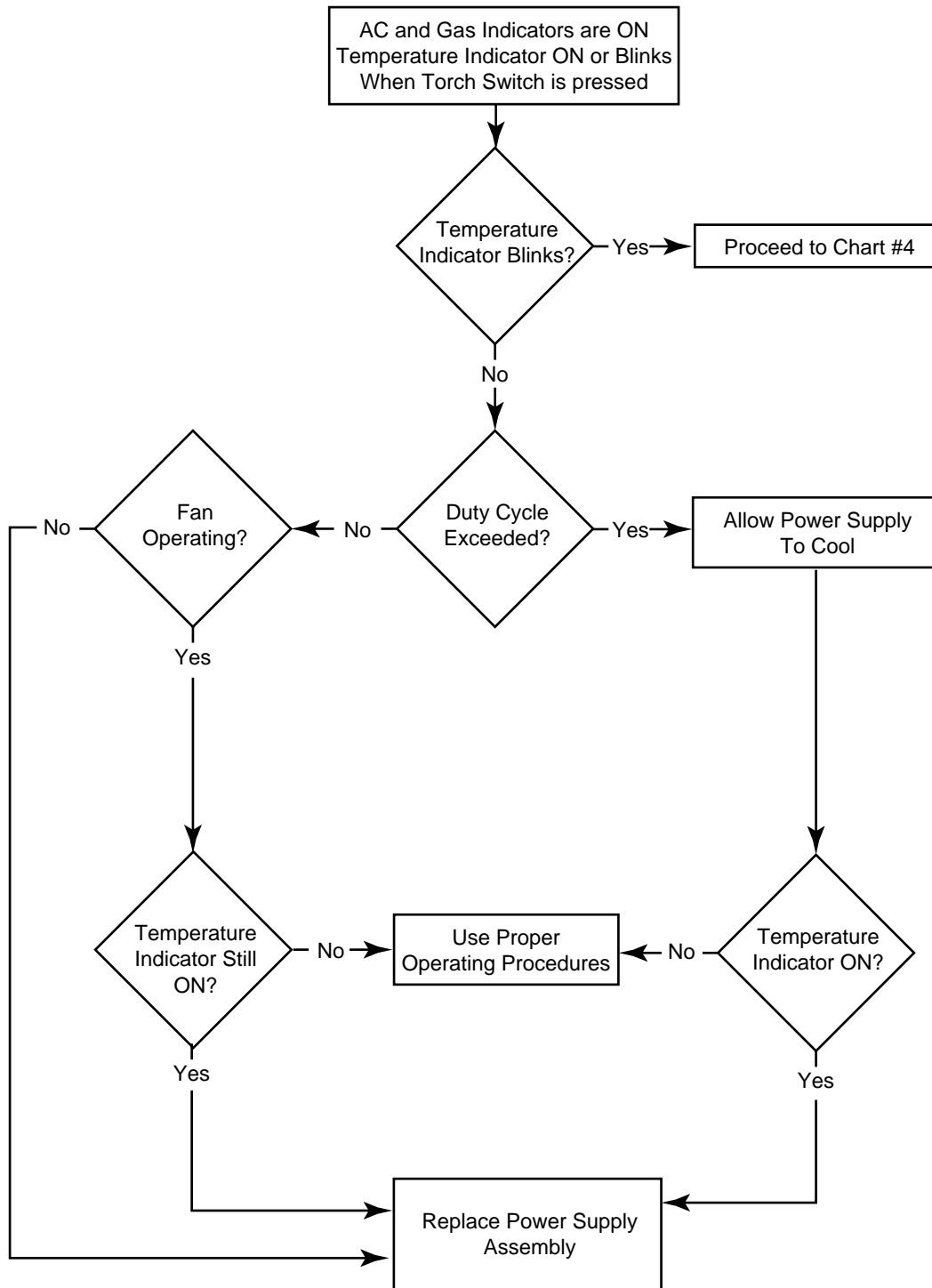


Chart #4: Shorted Torch or Resistor (R3) Checks

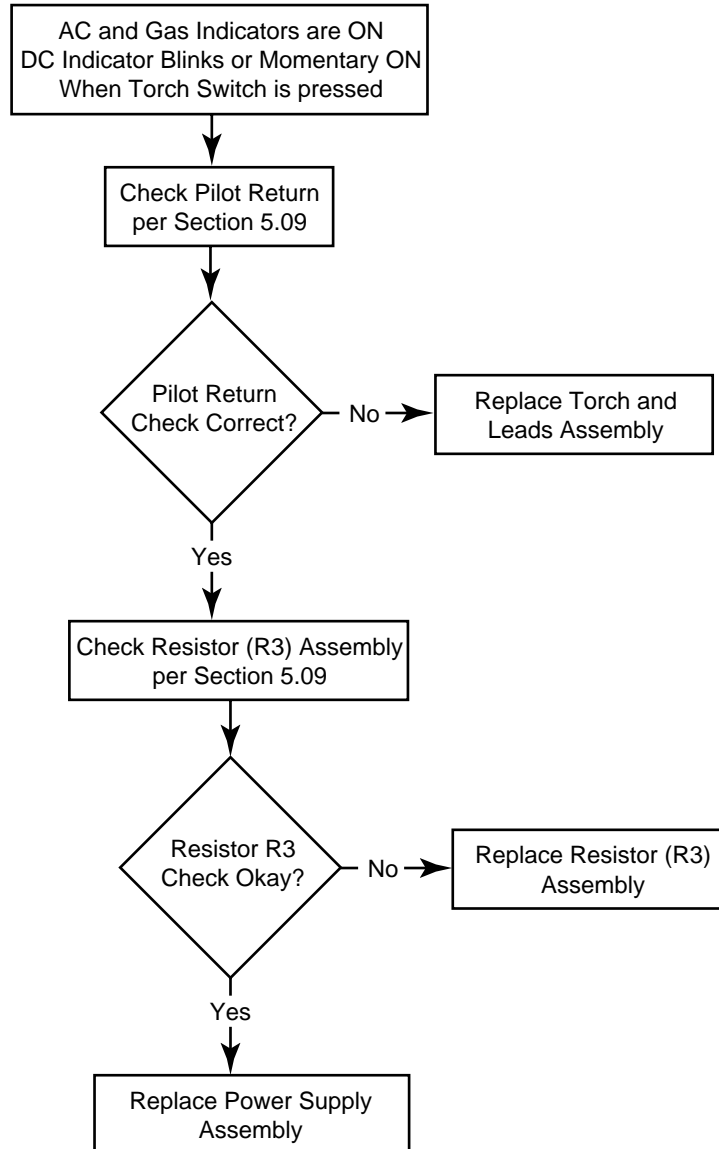


Chart #5: Faulty Torch or Torch Switch Checks

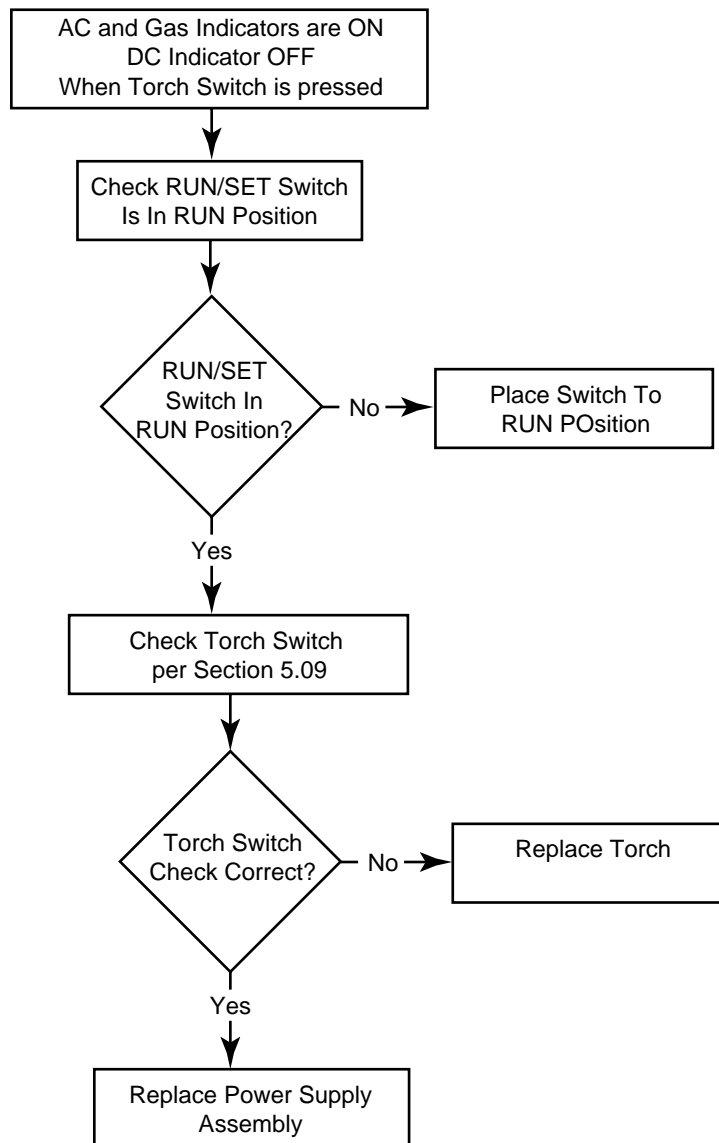
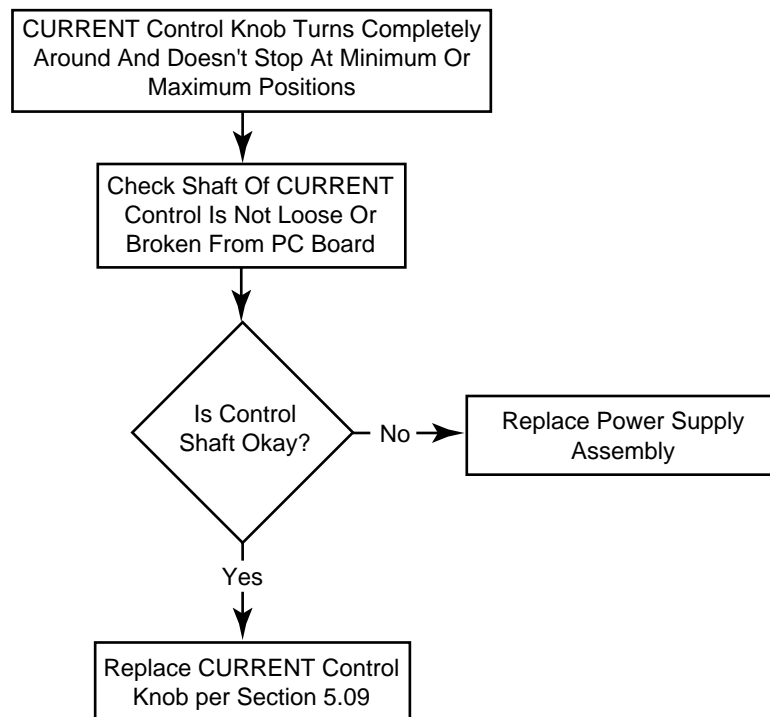


Chart #6: Possible Shipping Damage



5.09 Test Procedures

The checks in these test procedures are all made with the main power disconnected.



WARNINGS

Disconnect primary power to the system at the source before opening the Power Supply.

A. Checking Input Diode Bridge

Testing of diode modules requires a digital volt/ohm meter that has a diode test scale. Remember that even if the diode module checks good, it may still be bad. If in doubt, replace the Power Supply.

1. Open the Power Supply per Section 5.11-A.
2. Make a visual check of the Input Diode Bridge for damage.

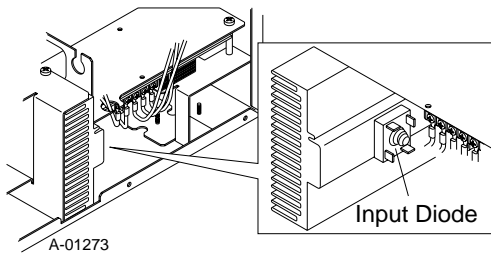


Figure 5-4 Input Diode Location

3. Set digital volt/ohm meter to diode test scale.
4. Using the Figures for each test, check each diode in the module. Each diode must be checked in forward bias (plus to negative) and reverse bias (negative to plus) direction.
5. Connect the volt/ohm meter positive lead to the anode (+) of the diode and the negative lead to the cathode (-) of the diode for forward bias testing. A properly functioning diode will conduct in the forward bias direction and indicate between 0.3 to 0.9 volts.

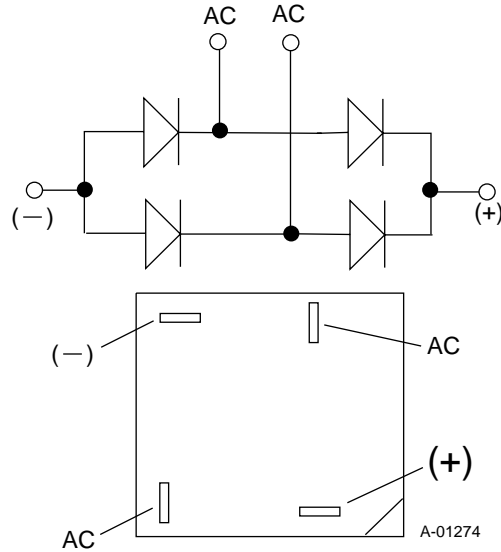


Figure 5-5 Input Diode Diagram

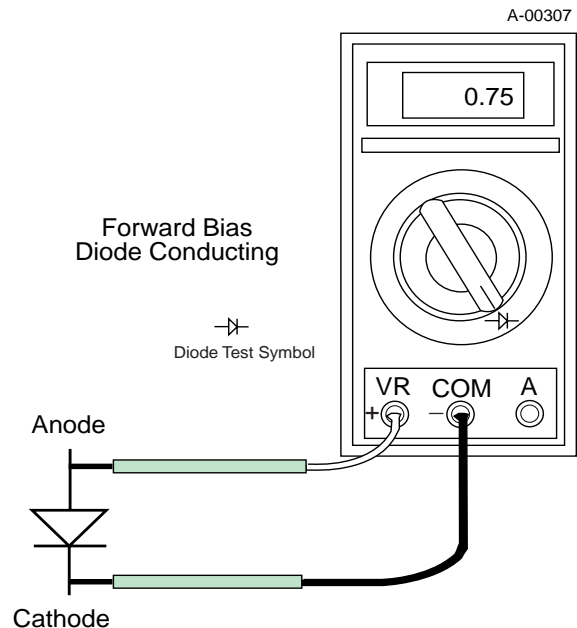


Figure 5-6 Testing Diode Forward Bias

6. Reverse the meter leads across the diode for reverse bias testing. A properly functioning diode will block in the reverse bias direction and depending on the meter function will indicate an open or "OL".

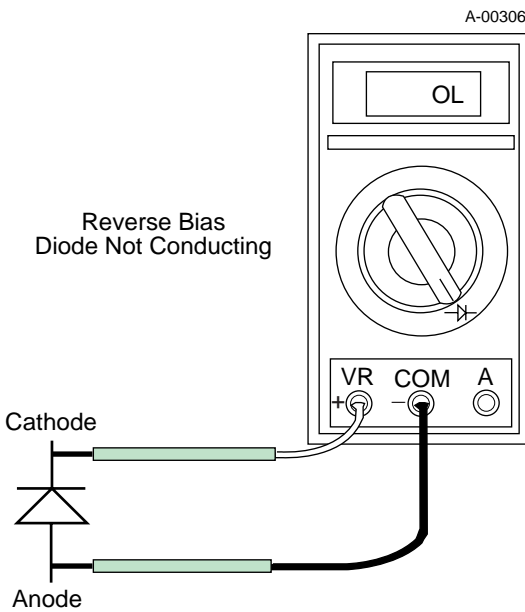


Figure 5-7 Testing Diode Reverse Bias

7. If the diode has visible damage or is shorted the diode is faulty, replace the Power Supply.

B. Checking FET Assemblies

1. Open the Power Supply per Section 5.11-A.
2. Using an ohmmeter set on the Rx1 scale make the following checks:

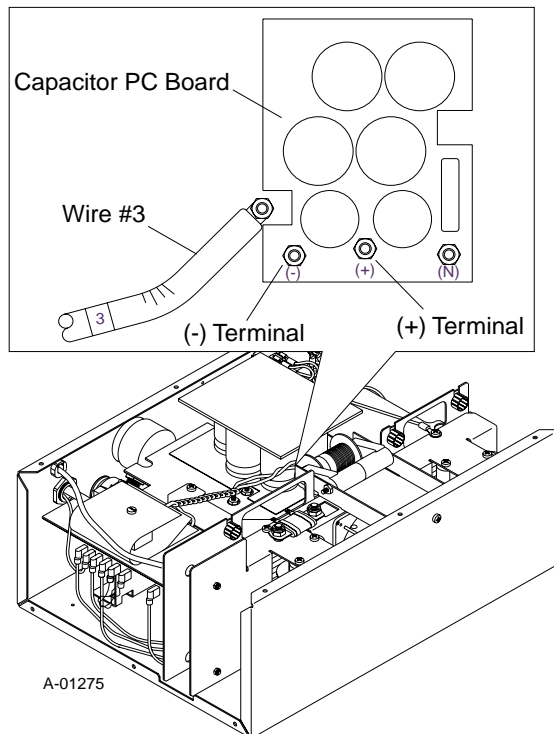


Figure 5-8 FET Assembly Check

- a. Measure from Capacitor PC Board (+) to Main Transformer Wire #3. If the meter indicates a short the FET Assemblies are faulty.
- b. Measure from Capacitor PC Board (-) to Main Transformer Wire #3. If the meter indicates a short the FET Assemblies are faulty.

C. Checking Capacitor PC Board

1. Open the Power Supply per Section 5.11-A.

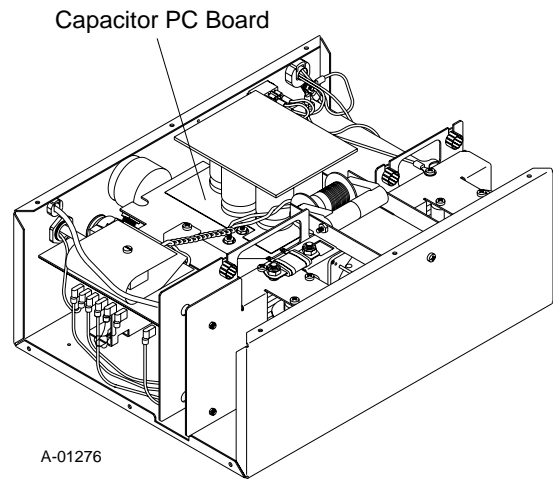


Figure 5-9 Capacitor PC Board Location

2. Using an ohmmeter set on the Rx1 scale make the following check:
 - a. Measure from Capacitor PC Board (+) to (-) terminals. The meter should increase in resistance as the capacitors charge. If the meter indication does not increase the Capacitor PC Board is faulty.

D. Checking Pilot Return

1. Open the Power Supply per Section 5.11-A.
2. Using a pair of needle nose pliers remove the red Pilot Return Lead wire from terminal E14 on the Main PC Board.

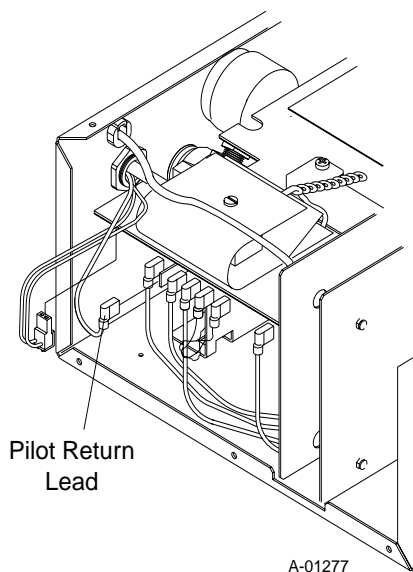


Figure 5-10 Pilot Return Lead Location

3. Using an ohmmeter set on the Rx1 scale make the following checks:
 - a. Measure from the Torch Block and the end of the Pilot Return wire. The meter indicate an open.
4. Reinstall the wire back onto the E14 terminal.

E. Checking Resistor R3 (11k ohms)

1. Open the Power Supply per Section 5.11-A.
2. Using a pair of needle nose pliers remove the red wire from terminal on Resistor R3.

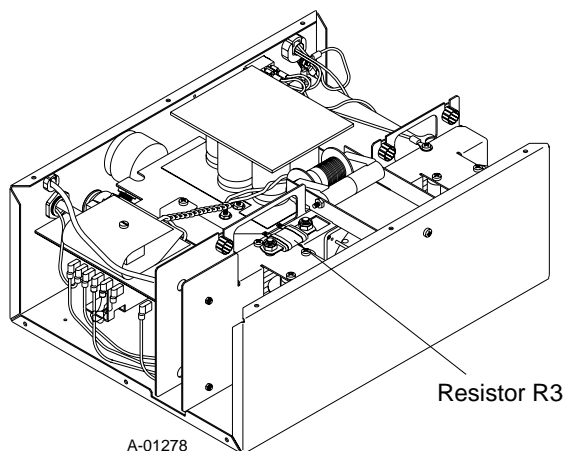


Figure 5-11 Resistor R3 Location

3. Using an ohmmeter set on the Rx100 scale make the following check:
 - a. Measure the Resistance of the Resistor R3. The meter should indicate 11K ohms.
4. Reinstall the wire back onto the Resistor terminal.

F. Checking Torch Switch

1. Open the Power Supply per Section 5.11-A.
2. Disconnect the Torch Switch Wire connector from the Main PC Board at J3 (black and white wires).

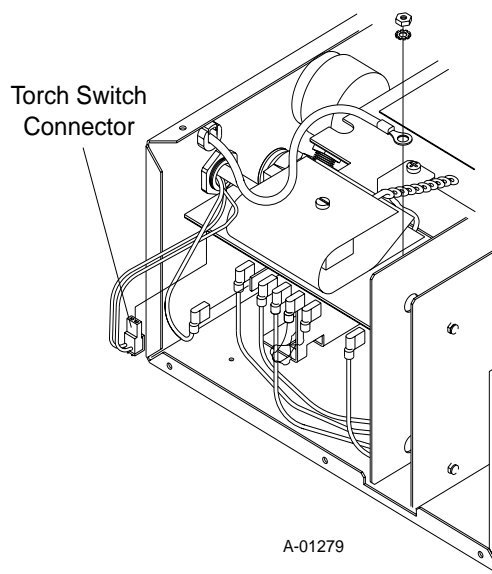


Figure 5-12 Torch Switch Connector Location

3. Using an ohmmeter set on the Rx1 scale make the following check:
 - a. Measure across the Torch Switch Wiring connector, black to white. The meter should indicate an open when the Torch Switch is not pressed. When pressed the meter should indicate a short.

NOTE

The Shield Cup must be installed to complete the circuit through the Parts-In-Place (PIP) contacts.

4. Reinstall the Torch Switch Wiring connector back onto the Main PC Board connector.

5.10 Torch And Leads Troubleshooting



WARNINGS

Disconnect primary power to the system before disassembling the torch or torch leads.

DO NOT touch any internal torch parts while the AC indicator light on the front panel of the Power Supply is ON.

A. Checking Center Insulator

1. Remove the shield cup, tip, gas distributor, and electrode from the torch.
2. Disconnect the torch leads from the power supply to isolate the torch from power supply circuits.
3. Using an ohmmeter (set to 10K or higher), check for continuity between the positive and negative torch quick disconnect fittings.

If there is continuity between the two torch quick disconnect fittings proceed to Step 4.

4. Remove the torch head from the leads (refer to Section 5.13, Servicing Torch Head Components).
5. With the torch head disconnected from the leads, measure the resistance between negative cathode body of the torch head (where the electrode seats) and the positive anode body of the torch head (the outer threads where the shield cup seats).

Infinite resistance (no continuity) should be measured between negative and positive sections of the torch head.

If any current can flow through the center insulator, the torch head is faulty and must be replaced.

If the torch head is okay, the problem is in the leads assembly. Proceed to Step 6.

6. Check torch leads by measuring the resistance between the plasma (+) lead connector and the coolant supply (-) lead fitting.

If continuity is found, replace the torch leads.

If no continuity is found, the torch leads are okay and the problem was in the way the components were assembled. Proceed to Step 7.

7. Carefully reassemble the components and recheck the completed assembly per Step 3 to confirm that the components have been properly assembled.

This completes the checks for the proper operation of the center insulator of the torch head and leads.

5.11 Power Supply Component Replacement Procedures



WARNING

Disconnect primary power to the system before disassembling the torch, leads, or power supply.

A. Opening Enclosure

1. Swing the handle into the forward position before removing any hardware.
2. Remove the six screws on the top of the unit and six screws on the sides of the unit.

NOTE

Do not remove the two screws holding the handle to the case or the single screw on the rear panel.

3. Slide the cover straight up and off the power supply. Pivot the cover over the torch lead, work lead, and power cord and rest the cover in front of the power supply.

NOTE

Make certain not to strain the ground wire connection to the cover of the power supply.

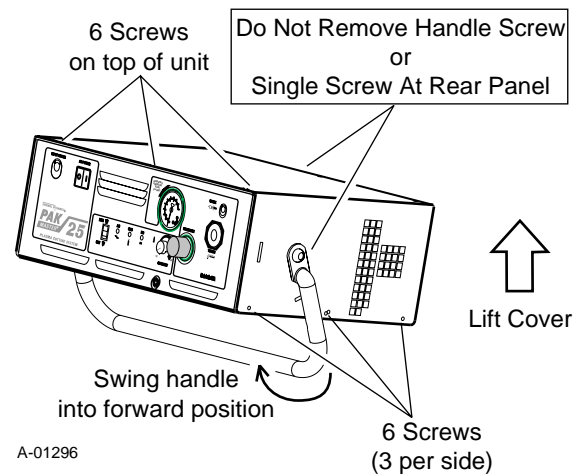


Figure 5-13 Opening Power Supply Enclosure

B. Current Knob Replacement

1. Using a small blade screwdriver loosen the screw securing the knob to the CURRENT Control adjustment shaft.
2. Turn the CURRENT Control adjustment shaft fully counterclockwise. This will represent the minimum position.
3. Slide the replacement knob onto the shaft.
4. Turn the knob so that the line on the knob points towards the 'C' in CURRENT.
5. Tighten the screw in the knob to secure the knob to the shaft.
6. Turn the knob fully clockwise.

7. The line should now line up with end of the CURRENT Control adjustment symbol.
8. Adjust the knob as required to align the minimum and maximum reference points.

C. Fuse(s) Replacement

The two Fuses are located on the Main PC Board inside the Power Supply. The Fuses are behind and next to the terminal block on the left side of the Power Supply.

NOTE

Removal of the Fuses requires the use of a pair of 90° needle nose pliers.

Remove the desired Fuse per the following procedure:

1. Remove the Power Supply Cover per paragraph 'A' above.
2. Using a pair of 90° needle nose pliers carefully remove the Fuse(s).
3. Replace the Fuse(s) only with the properly rated and type fuse. Fuse, F1, is next to the Terminal Block and is a 1/2 amp fuse. The other Fuse, F2, is a 30 amp fuse.

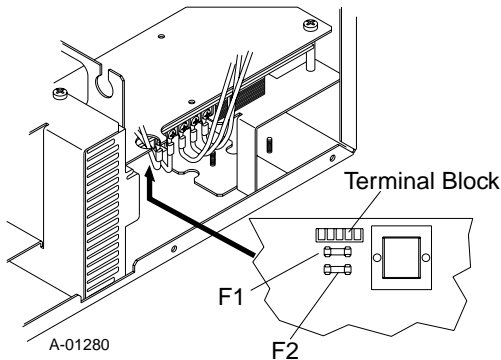


Figure 5-14 Fuse F1 and F2 Location

4. Reinstall the Power Supply Cover.

D. AC POWER Switch Replacement

1. Open the enclosure per paragraph 'A' above.
2. Disconnect the wiring from the rear of the AC Power Switch.

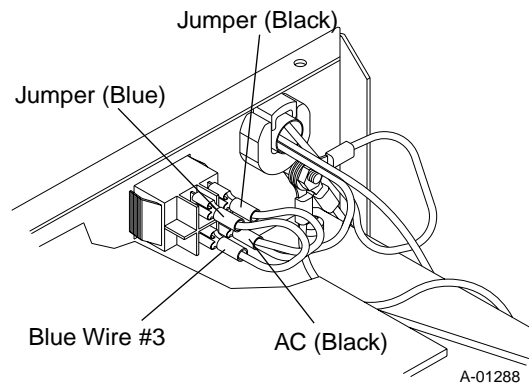


Figure 5-15 Power Switch Connections

3. Press in on the tabs on each side of the switch and push the switch out through the Front Panel.
4. Replace the replacement AC Power Switch by reversing the above procedure.

E. Air Regulator Assembly Replacement

The Air Regulator Assembly includes the Air Regulator, Pressure Switch, Pressure Gauge, and Solenoid Assemblies and is removed from the Power Supply as a complete assembly. Remove the assembly per the following procedure:

1. Open the enclosure per paragraph 'A' above.
2. Disconnect the ground wire from the cover, and set the cover aside.
3. Disconnect the Torch Leads from bulkhead inside the Power Supply per Section 5.12.
4. Disconnect the pilot wire, torch switch wires and work cable from the Main PC Board.

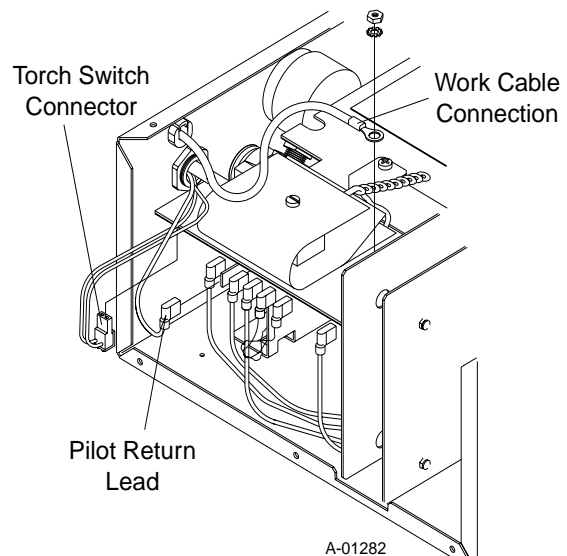


Figure 5-16 Connection Locations

5. Remove the AC input power and ground connections to the Main PC Board.
6. Remove the four screws from the base of the Power Supply and the single screw on the rear of the Power Supply.
7. Push back the regulator hose fitting clamp and slide the complete Heatsink/Main PC Board Assembly back and up out of the way.
8. Remove retaining nut from front of the regulator assembly, and remove complete assembly with wiring.
9. Remove the faulty Air Regulator, Pressure Switch, Pressure Gauge, or Solenoid Assembly and install the replacement assembly.
10. Install complete Air Regulator Assembly by reversing the above procedure.

NOTE

Properly route the pressure switch and gas solenoid wires and secure with cable ties.

F. Heatsink/PC Board Assembly Replacement

The Heatsink/Main PC Board Assembly is replaced as a complete assembly. Replace the assembly per the following procedure:

1. Open the enclosure per paragraph 'A' above.
2. Disconnect the ground wire from the cover, and set the cover aside.
3. Disconnect the Torch Leads from bulkhead inside the Power Supply per Section 5.12.
4. Disconnect the pilot wire, torch switch wires and work cable from the Main PC Board per paragraph E-Step #4 above.
5. Remove the AC input power and ground connections to the Main PC Board.
6. Remove the four screws from the base of the Power Supply and the single screw on the rear of the Power Supply.
7. Remove retaining nut from front of the Air Regulator Assembly.
8. Slide the complete Heatsink/Main PC Board Assembly with Air Regulator Assembly attached back and up out of the unit.
9. Push back the regulator hose fitting clamp and slide the complete Air Regulator Assembly with wiring from the Heatsink/Main PC Board Assembly.

10. Install replacement Heatsink/Main PC Board Assembly by reversing the above procedure.

G. Capacitor PC Board Replacement Procedure

1. Open the enclosure per paragraph 'A' above.
2. Remove the three nuts and star washers securing the Capacitor PC Board to the Heatsink/PC Board Assembly. The nuts are located at terminals (+), (-), and (N).
3. Pull the Capacitor PC Board up from the three plastic PC Mounting Standoffs.
4. Remove the black pad on top of the capacitors from the faulty Capacitor PC Board.
5. Install the replacement Capacitor PC Board by reversing the above procedure and noting the following:
 - a. Place the black pad removed from the faulty PC Board on top of the capacitors on the replacement PC Board.
 - b. Refer to the following CAUTION and torque the three nuts on terminals (+), (-), and (N) to 15 inch-lbs (1.695 Nm)

CAUTION

DO NOT over torque the nuts on the terminals as the PC Board may be damaged.

H. Pilot Resistor Replacement Procedure

1. Open the enclosure per paragraph 'A' above.
2. Locate the Pilot Resistor on the right-rear of the Heatsink/PC Board Assembly.

NOTE

There are two resistors mounted to this area, Pilot Resistor (15 ohms) and Damping Resistor (30 ohms). The Pilot Resistor is mounted on the bottom.

3. Using a socket or nut driver remove the two nuts securing the Pilot and Damping Resistors to the Heatsink/PC Board Assembly.
4. Pull the Pilot Resistor out far enough to gain access to the two wiring connections.
5. Remove the two wires connected to the Pilot Resistor noting the locate of each.
6. Install the replacement Pilot Resistor by reversing the above procedure.

5.12 Torch and Leads Replacement Procedure

1. Open Power Supply Enclosure per Section 5.11-A.
2. Locate the torch bulkhead directly behind the torch lead panel strain relief.

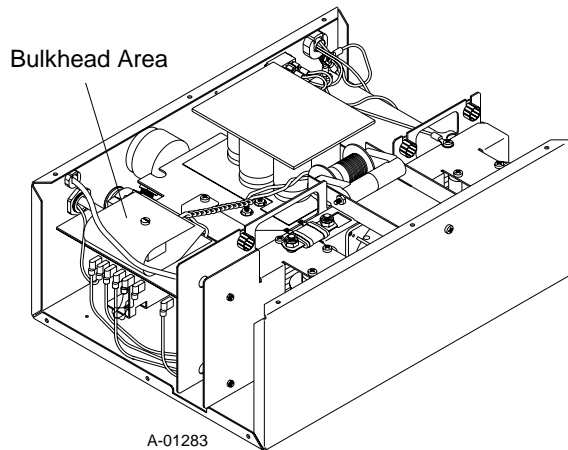


Figure 5-17 Torch Bulkhead Location

NOTE

Note that all wires are outside the protective insulating sheet.

3. Remove the nylon screw holding the protective insulating sheet to the bulkhead.

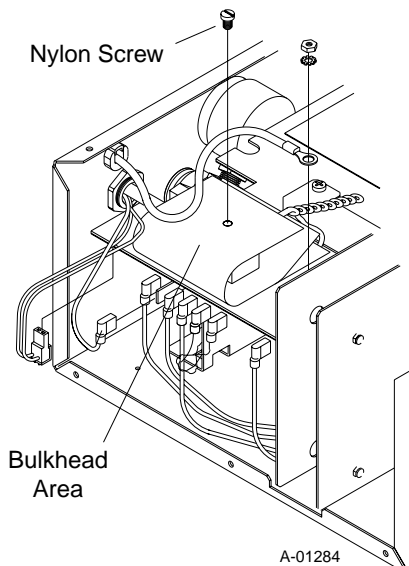


Figure 5-18 Nylon Screw

4. Loosen the torch lead strain relief nut inside the front panel. Do not remove the strain relief from the leads. Replacement torch leads are provided with strain reliefs.

5. Disconnect the two pin torch switch connector (white and black wires) and the red pilot wire (terminal 2) from the Main PC Board Assembly side connectors.

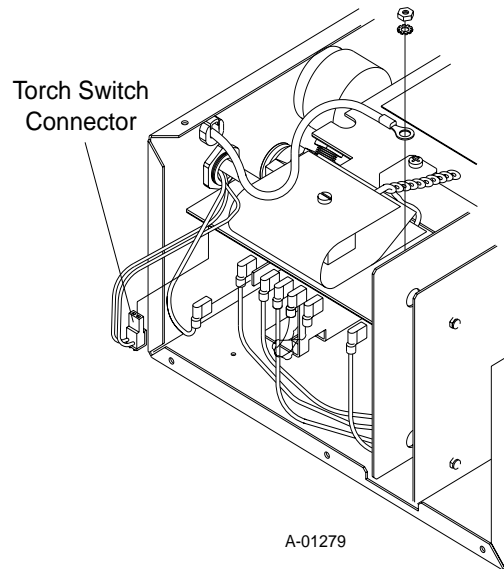


Figure 5-19 Wiring Connections

6. Use a 3/8 inch (9.5 mm) open end wrench to loosen the negative lead fitting to the brass torch bulkhead.

CAUTION

Be sure all wires are outside the protective insulating sheet as noted above when it is reinstalled. High voltage is present on the torch negative lead.

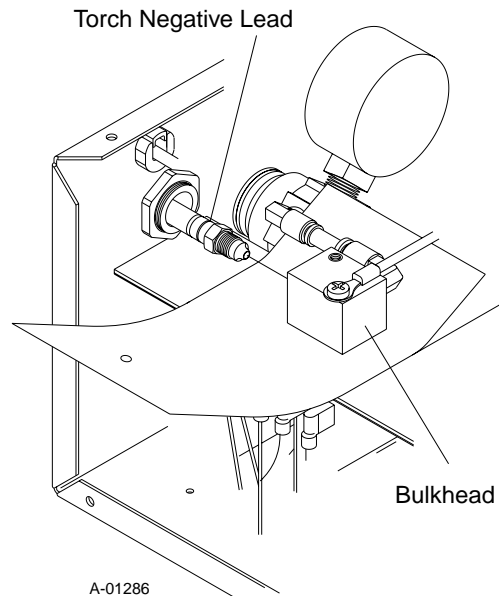


Figure 5-20 Torch Lead Connection

5.13 Servicing Torch Head Components



WARNING

Disconnect primary power to the system before disassembling the torch, leads, or power supply.

NEVER touch any internal torch parts while the AC indicator light on the front panel of the control module is lit.

A. Removing Torch Head

1. Remove the six screws from the torch handle assembly. Pull the cover off the handle to expose the leads and torch switch/PIP connections.

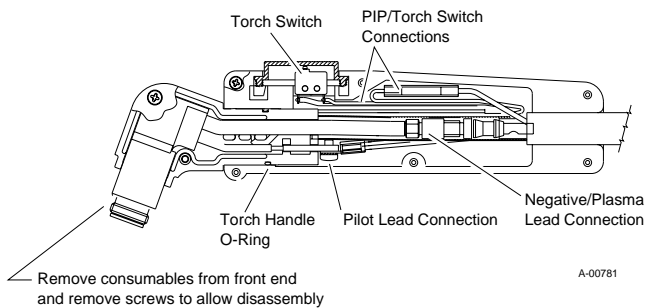


Figure 5-21 Torch Head Assembly in Handle

2. Disconnect the negative/plasma and pilot lead connection at the torch head.

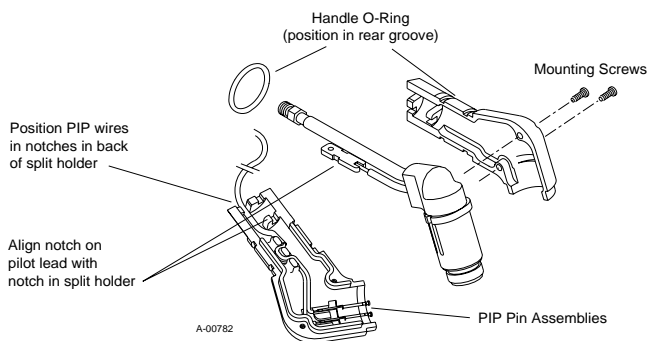


Figure 5-22 Disassembling the Split Holder

3. Slip off the rear O-Ring, remove the two screws from the torch head split holder, and separate the halves. Remove the torch head from the holder.

4. Carefully remove the torch switch and switch button from the handle. Make sure the two small springs stay in place on the switch button. Do not disturb the PIP wiring in the torch head housing.



WARNING

Disconnect primary power to the system before disassembling the torch, leads, or power supply.

B. Replacing the PIP Assembly

1. Carefully remove the PIP wires from the strain relief bosses inside the split holder.

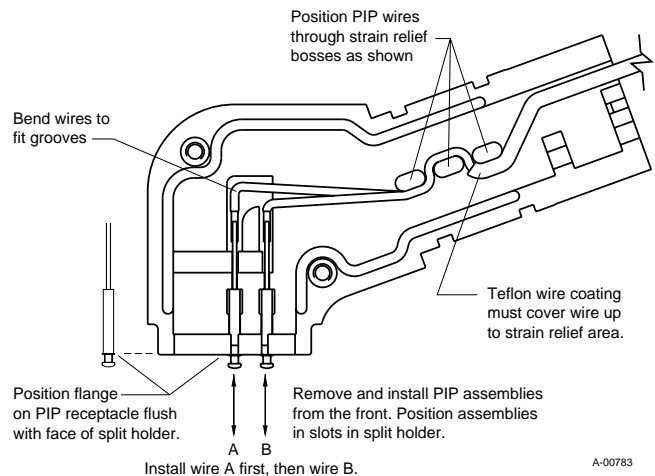


Figure 5-23 Installing a Replacement PIP Assembly

2. Slide the PIP pin receptacles forward out of the retention slots.

CAUTION

Do not lift the PIP pin receptacles out of the split holder. Damage to holder and/or PIP pin receptacles may occur.

3. Install replacement PIP pin assemblies by positioning the square solder post of the PIP pin receptacle in the retention slot in the split holder and sliding the assembly up into place. Position the flange on the PIP pin receptacle flush with the front face of the split holder.
4. Route the PIP wires around the strain relief bosses as shown. Push the teflon insulation on each PIP wire up to the strain relief boss closest to the back of the split holder for voltage insulation from the brass pilot lead connector.
5. Position both PIP leads through the notch where the negative/plasma lead exits the holder.

- Position the torch head inside the holder. Align the notch on the pilot lead with the corresponding tab on the split holder. Make sure the negative/plasma fitting is securely inserted in the groove in the holder. Make sure the crescent on the torch head is inserted into the mating groove in the holder.
- Place the second half of the holder over the torch head. Confirm that the PIP pin assemblies, PIP leads, and the negative/plasma and pilot leads are properly positioned.

CAUTION

Do not force the holder together. Damage to the insulation on the leads will cause torch head failure. The PIP leads must be positioned correctly to allow reassembly of the torch head.

C. Reassembling the Torch Head

- Install the two assembly screws to secure the split holder and reinstall the O-ring in the rear groove on the back of the torch head assembly.

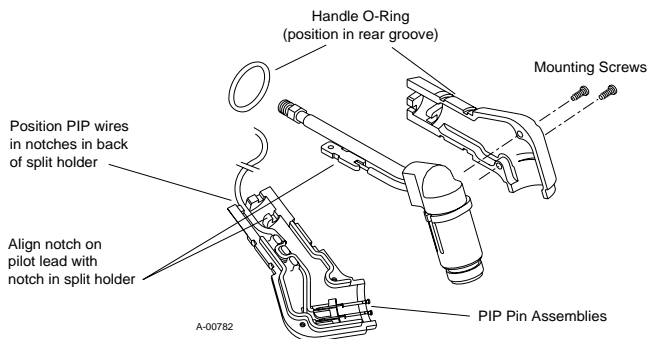


Figure 5-24 Assembling the Split Holder

- Install the front end torch parts.



WARNING

Disconnect primary power to the system before disassembling the torch, leads, or power supply.

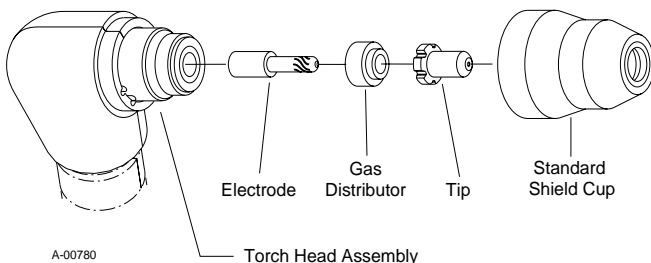


Figure 5-25 Consumable Parts

D. Replacing Torch Switch or Torch Leads to Head

- Unsolder the lead(s) at the torch switch being careful not to damage the wires.
- Carefully solder the wire(s) to the terminals on the replacement torch switch.

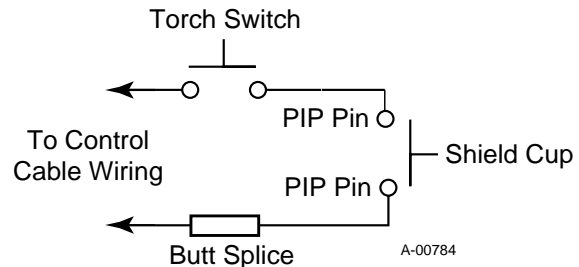


Figure 5-26 Torch Switch Schematic

NOTE

Be careful not to overheat the torch switch while soldering the leads to the terminals.

E. Reassembling the Torch Handle and Switch Assembly

- Connect the plasma and pilot lead connections at the torch head.

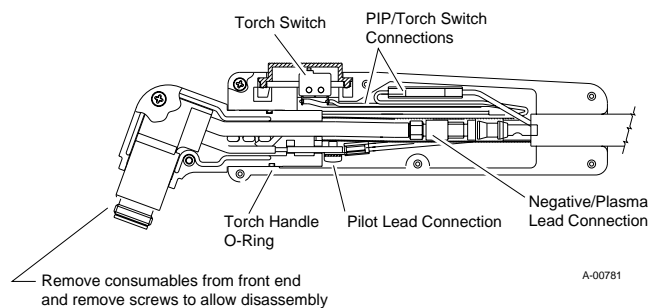


Figure 5-27 Torch Head Assembly in Handle

- Place the torch head in the handle and carefully return the torch switch and button to their proper position.

NOTE

Make sure torch switch and PIP wires are seated in their guides so that the wires are not pinched when the handle is secured.

- Replace the cover on the handle assembly and tighten the six retaining screws.

SECTION 6: PARTS LISTS

6.01 Introduction

A. Parts List Breakdown

The parts list provides a breakdown of all replaceable components. Power Supply and Torch Assembly are field serviceable, so a complete breakdown of parts is provided. The parts lists are arranged as follows:

Section 6.03: Power Supply Replacement Parts

Section 6.04: Complete Assembly Replacements

Section 6.05: Torch Assembly Replacement Parts

Section 6.06: Options And Accessories

Section 6.07: Torch Spare Parts Kit

NOTE

Parts listed without item numbers are not illustrated, but may be ordered by the catalog numbers shown.

B. Returns

If a Thermal Dynamics product must be returned for service, contact your Thermal Dynamics distributor. Materials returned to Thermal Dynamics without proper authorization will not be accepted.

6.02 Ordering Information

Order replacement parts by catalog number and complete description of the part or assembly, as listed in the description column of the Parts List. Also include the model and serial number of the torch. Address all inquiries to your authorized Thermal Dynamics distributor.

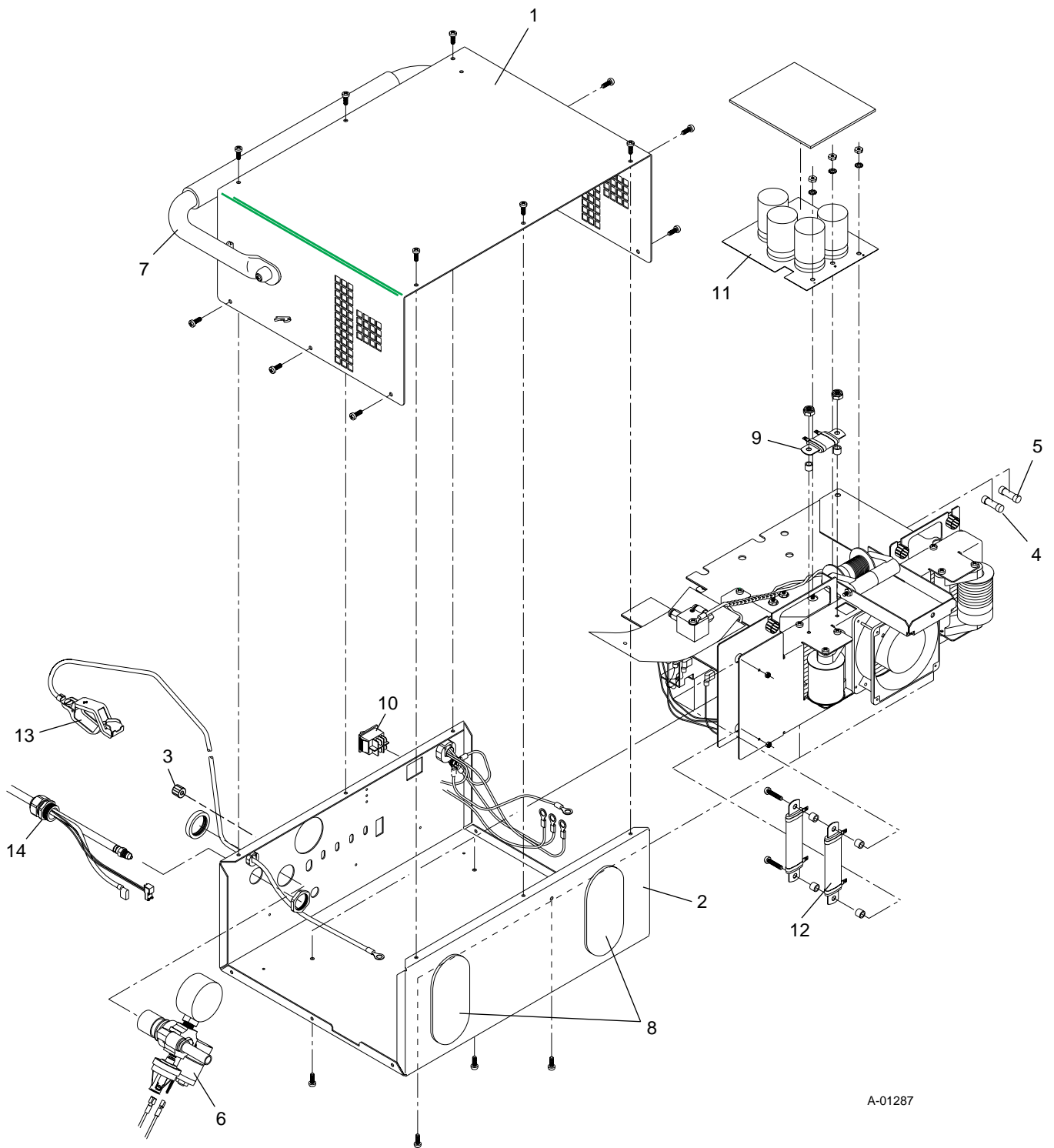
6.03 Power Supply Replacement Parts

Item #	Qty	Description	Catalog #
1	1	Cover	9-6394
2	1	Base	9-6393
3	1	Knob	9-4146
4	1	Fuse, 30 Amp (F2)	9-6396
5	1	Fuse, 1/2 Amp, 250V (F1)	9-6395
6	1	Air Regulator Assembly:	
		For units with revision letter 'G' or earlier	9-6283
		For units with revision letter 'H' or later	9-6898
	1	Air Regulator	8-4382
	1	Pressure Gauge	9-7641
	1	Pressure Switch	9-1044
	1	Solenoid With Wiring	9-6295
7	1	Handle	9-6288
8	2	Pad, Skid, Rubber	9-6299
9	1	Resistor (R3), 11K ohms	
		30W - For units with revision letter 'D' or earlier (see note)	9-4534
		40W - For units with revision letter 'E' or later (see note)	9-7701
10	1	ON/OFF Switch	9-6392
11	1	Capacitor PC Board Assembly	9-6324
12	1	Pilot Resistor (R1), 15 ohms 55W	9-6323
13	1	Work Cable with Clamp	9-6298
14	1	Torch and Leads Assembly (refer to Section 6.05 for Parts)	

The following items are not shown:

1	Torch Parts Label	9-6285
1	Warning Label	9-6286

NOTE: Revision level of the unit is the letter at the end of the unit serial number.



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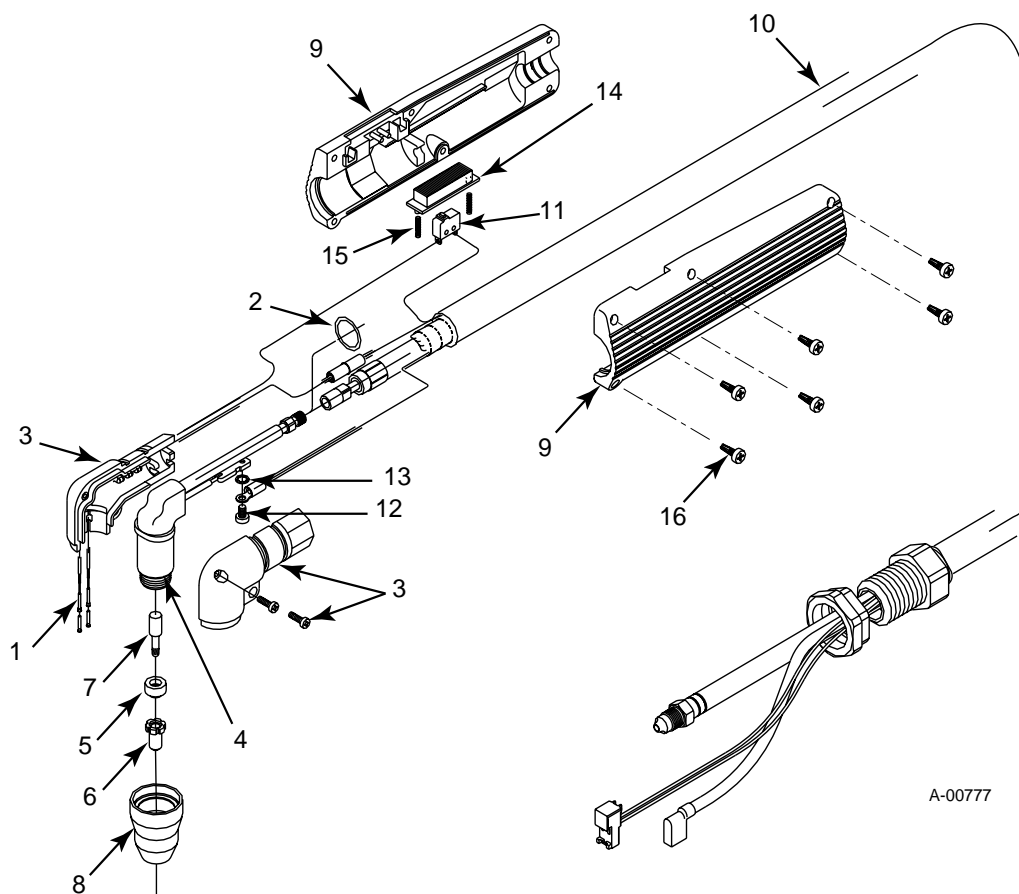
6.04 Complete Assembly Replacement

Catalog #	Description
System includes Pak Master 25 Power Supply, PCH-25 Torch with Leads, Spare Parts Kit, Input and Ground Cables.	
Pak Master 25 Systems With:	
70° Torch with 12.5 ft (3.8 m) Leads	1-0250
70° Torch with 25 ft (7.6 m) Leads	1-0251
90° Torch with 12.5 ft (3.8 m) Leads	1-0252
90° Torch with 25 ft (7.6 m) Leads	1-0253
Pak Master 25 Power Supply Only	3-0250
Replacement Hand Torches with Leads Only:	
PCH-25 70° Torch with 12.5 ft (3.8 m) Leads	2-0250
PCH-25 70° Torch with 25 ft (7.6 m) Leads	2-0251
PCH-25 90° Torch with 12.5 ft (3.8 m) Leads	2-0252
PCH-25 90° Torch with 25 ft (7.6 m) Leads	2-0253

6.05 Torch Replacement Parts

Item #	Qty	Description	Catalog #
1	1	Assembly, PIP (Parts-In-Place) Pins and Wire	9-6103
2	2	O-Ring	8-0533
3	1	Holder, Torch, Split, PCH25 70° Two Parts w/Screws	9-6259
	1	Holder, Torch, Split, PCH25 90° Two Parts w/Screws	9-6260
4	1	Assembly, Basic Head, PCH25 70°	9-5807
	1	Assembly, Basic Head, PCH25 90°	9-5808
5	1	Distributor, Gas	9-6007
6	1	Tip, Air, 0.028 Orifice, Drag Cutting	9-4476
7	1	Electrode, Air	9-6006
8	1	Shield Cup, Standard	9-6003
9	1	Handle, Split, PCH-25 Two Parts (Includes Items #14 thru 16)	9-6282
10	1	Lead Assembly, Composite Cable	
		12.5 ft (3.8m) Length	4-6067
		25 ft (7.6m) Length	4-6068
11	1	Switch, Torch	9-1058
12	1	#6-32 x 3/16 Phillips Pan Head Screw	See Note
13	1	#6 Internal Star Washer	See Note
14	1	Button, Split Holder	8-4256
15	2	Spring	9-6292
16	6	#2-56 x 5/16" Phillips Pan Head Screw	See Note

NOTE: Item can be purchased locally.



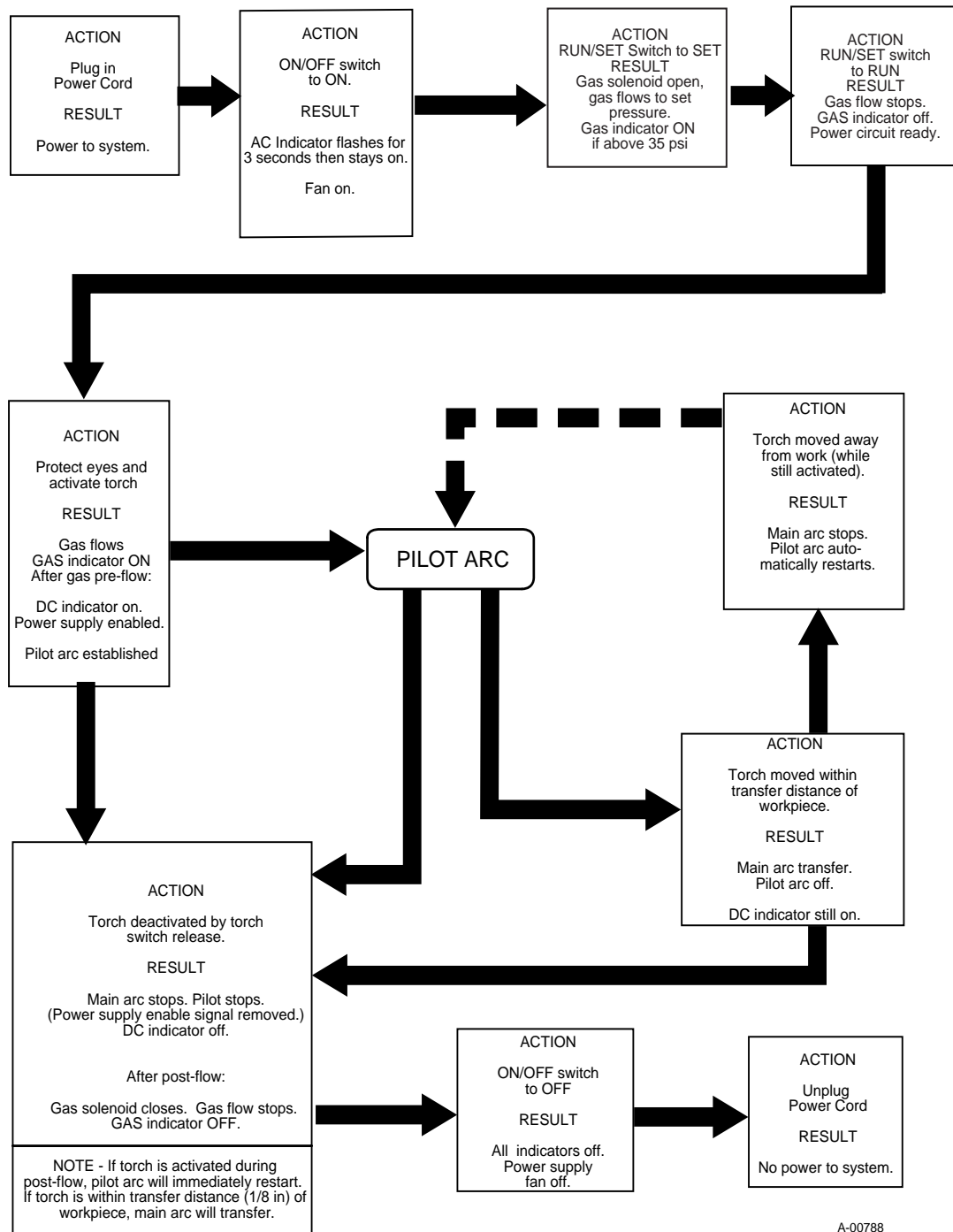
6.06 Options and Accessories

Description	Catalog #
Circle Cutting Attachment	7-3291
Leads Storage Kit	7-0253
Single Stage In-Line Air Filter	7-0250
Replacement Cartridge	7-0252

6.07 Torch Spare Parts Kit

Qty	Description	Catalog #
1	Spare Parts Kit, PCH-25 Includes:	5-0250
5	Tip, 0.028" Orifice, Drag Cutting	9-4476
3	Electrode, Air	9-6006
1	Distributor, Gas	9-6007
1	Box, Utility 4-5/8 x 3 x 1-1/8, Clear, Lug Hinge	8-3213

APPENDIX I: SEQUENCE OF OPERATION BLOCK DIAGRAM



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APPENDIX II: CUTTING SPEED CHARTS

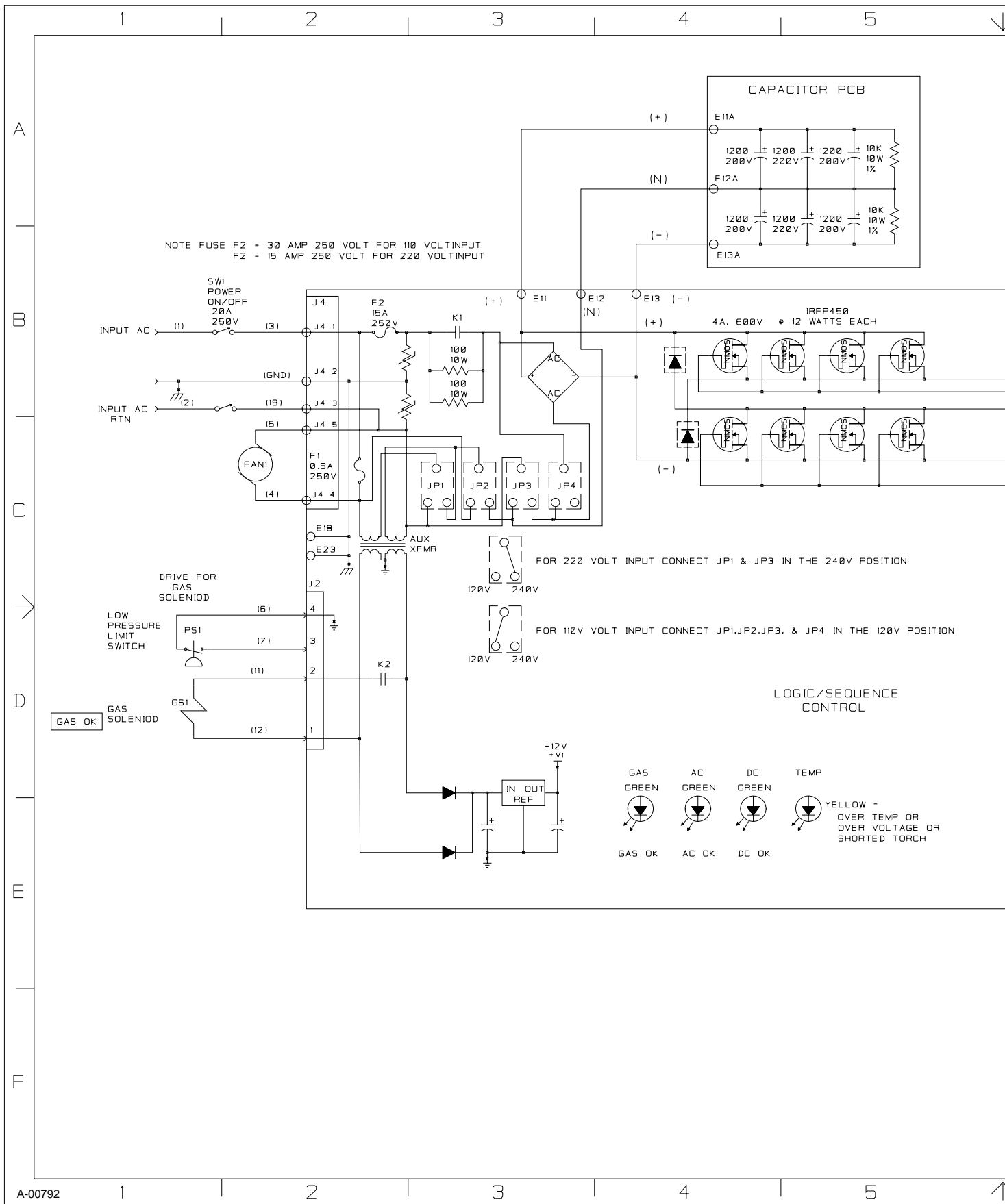
Material	Thickness	Cut Speed (IPM)	Amps	Gas / Pressure	Stand Off
Mild Steel	26 Gauge	250	20	Air / 50 psi	Drag - 1/8"
	20 Gauge	125	20	Air / 50 psi	Drag - 1/8"
	1/16" (1.6 mm)	85	20	Air / 50 psi	Drag - 1/8"
	1/8" (3.2 mm)	25	20	Air / 50 psi	Drag - 1/8"
	3/16" (4.8 mm)	15	20	Air / 50 psi	Drag - 1/16"
	1/4" (6.4 mm)	8	20	Air / 50 psi	Drag - 1/16"

Material	Thickness	Cut Speed (IPM)	Amps	Gas / Pressure	Stand Off
Stainless Steel	20 Gauge	125	20	Air / 50 psi	Drag - 1/8"
	1/16" (1.6 mm)	40	20	Air / 50 psi	Drag - 1/8"
	1/8" (3.2 mm)	25	20	Air / 50 psi	Drag - 1/8"
	3/16" (4.8 mm)	10	20	Air / 50 psi	Drag - 1/16"

Material	Thickness	Cut Speed (IPM)	Amps	Gas / Pressure	Stand Off
Galvanized Steel	24 Gauge	100	20	Air / 50 psi	Drag - 1/8"
	20 Gauge	75	20	Air / 50 psi	Drag - 1/8"
	18 Gauge	65	20	Air / 50 psi	Drag - 1/8"
	1/16" (1.6 mm)	45	20	Air / 50 psi	Drag - 1/8"
	5/64" (2.0 mm)	30	20	Air / 50 psi	Drag - 1/8"

Material	Thickness	Cut Speed (IPM)	Amps	Gas / Pressure	Stand Off
Aluminum	24 Gauge	250	20	Air / 50 psi	Drag - 1/8"
	22 Gauge	200	20	Air / 50 psi	Drag - 1/8"
	1/16" (1.6 mm)	150	20	Air / 50 psi	Drag - 1/8"
	3/32" (2.4 mm)	25	20	Air / 50 psi	Drag - 1/8"
	1/8" (3.2 mm)	10	20	Air / 50 psi	Drag - 1/8"

APPENDIX III: SYSTEM SCHEMATIC



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